the OIL AND GAS JOURNAL

NOVEMBER 12, 1956

ERSONALITIES . . . . . PROGRAMS . . . . . INDUSTRY NEWS . . . . . SPECIAL

Pre-A.P.I. Number

36TH ANNUAL AMERICAN PETROLEUM INSTITUTE MEET

The Journal Predicts For Next 5 Years . . .

DEMAND

Annual gain of 4 per cent

DRILLING

72,000 wells in 1961

REFINING

Capacity gain to 11,000,000 bbl.

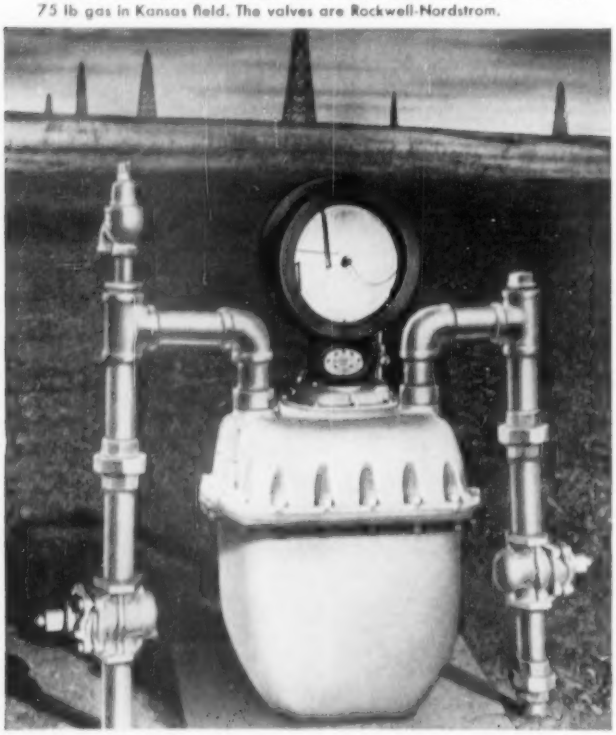
PIPELINING

Gas for four major lines a year.

p. 144

(ABOVE) Installation of two Rockwell "800" meters in West Texas field with manifold controlled by Rockwell-Nordstrom valves.

(BELOW) Rockwell "800" meter with Combined Record Gauge measuring 75 lb gas in Kansas field. The valves are Rockwell-Nordstrom.



Recommended installation is off the ground and away from alkaline soil.

Portable, Corrosion Resistant Rockwell Aluminum Meters

MEASURE FIELD GAS

at up to 100 lb. working pressure

The Rockwell "800" is "made-to-measure" for gas sold or used on the lease. It weighs only 63 lbs, so is readily portable. The sturdy aluminum outer case withstands weathering and takes bumps and knocks in stride. There's a generous capacity rating of 1600 cfh at 4 oz inlet. This can be materially increased by measuring gas at higher pressures . . . up to 100 psi. Corrections for volume at high pressures are available with either a Rockwell Emcorector or a Combined Record Gauge. Write for full details.

Use For All These Field Applications:

- LEASE ACCOUNTING
- INTER-COMPANY REPORTS
- INTRA-COMPANY SALES
- PIPE LINE TAPS
- FIELD PROCESSING
- IRRIGATION FUEL SERVICE

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ROCKWELL MANUFACTURING COMPANY

PITTSBURGH 8, PA. Atlanta Boston Charlotte Chicago Dallas Denver Houston Los Angeles Midland, Tex. New Orleans New York N. Kansas City Philadelphia Pittsburgh San Francisco Seattle Shreveport Tulsa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Toronto, Ontario

ROCKWELL "800" Aluminum GAS METER

A Glance Ahead . . . . at press time

These trends will make TOMORROW'S NEWS

Statehood for Alaska without further delay will be recommended to Congress next year by the Interior Department.

But the grant of statehood will not restore to Alaska the large acreages carved out of the territory by the Government for military and other purposes. These include the more than 20,000,000 acres in North Alaska set aside as an addition to Naval Petroleum Reserve No. 4. But the department long has planned to release this acreage for private development, and may find it easier to do so if statehood is granted.

Redistribution of water from surplus-rainfall areas in East Texas to needy areas farther west is contemplated by the U. S. Bureau of Reclamation.

The bureau is advancing a plan for a 450-mile, 200-ft. wide canal to be dug parallel to the coast and about 60 to 70 miles inland. It would receive water from rivers in East Texas, deliver it along the coast westward to the Rio Grande.

It would make water available for flooding operations and industrial needs in addition to irrigation. Cost: Well over a billion dollars. It may never come to pass, but California has moved water farther over more rugged terrain.

Refiners who make low-sulfur delayed coke should take a look at the prices they're getting. Demand for aluminum and other metallurgical electrode uses is rising faster than projected production of preferred grades of delayed coke, and customers are having to accept higher sulfur contents than they like.

This, plus the probable rise in sulfur content of all crudes to be run to domestic stills in the future, gives the producer of low-sulfur delayed coke a prime position.

Watch the performance of the new drilling-mud additive ferrochrome lignosulfonate. This additive acts as a thinner and a gel-strength reducer for gyp-based muds; it can reduce the usual high initial gel and make muds more usable.

The additive should be a boon to the Rocky Mountain area, where gyp muds are necessary for drilling anhydrite beds. But an easily controlled gyp mud may be of interest in the Gulf Coast area for the first time—for use at high temperatures without gelation.

A strong market for residual in California is in prospect this winter—just the opposite of a year ago when top-heavy inventories were unloaded on the Atlantic seaboard and in foreign markets.

Principal reason is the smaller yield of residual obtained from imports of 200,000 bbl. daily of light foreign crude. New coking units soon to go into operation—with a total capacity of 46,000 bbl.—will further reduce available supplies.

An example of making research pay is Carter Oil Co.'s new magnetic recording and playback system for handling seismic data (O.G.J., October 29, page 70). Carter has what it set out to develop: a lower-cost, high-quality instrument to strengthen the oil-finding programs of the affiliated Jersey Standard companies it supplies as well as its own program. And royalties from licensing arrangements are expected to return the entire cost of development by 1959.

the OIL AND GAS JOURNAL

NOVEMBER 12, 1956 • VOLUME 54 • NUMBER 80

THE STAFF

TULSA OFFICE
211 South Cheyenne Ave.
Phone Diamond 3-6291

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Henry D. Ralph ... Chief Editorial Writer
Ted A. Armstrong ... News Editor
Gerald L. Farrar ... Engineering Editor
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NEW YORK OFFICE
500 Fifth Avenue
Phone LOngacre 4-6160

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Paul Swain ... International Editor
Ray G. Gibson ... District Editor
John P. O'Donnell ... District Editor

HOUSTON OFFICE
802 Sterling Building
Phone CApitol 4-7726

Larry Reser ... District Editor
Ed McGhee ... District Editor
Joe Reilly ... District Editor

DALLAS OFFICE
1238 Mercantile Bank Building
Phone STerling 3074

Robert J. Enright ... District Editor

LOS ANGELES OFFICE
650 South Grand Avenue
Phone VAndike 0722

D. H. Stormont ... District Editor
William T. Smith ... District Editor

WASHINGTON OFFICE
621 Albee Building
Phone District 7-1710

Bertram F. Linz ... District Editor

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The Oil and Gas Journal, Published Mondays, copyright 1956, by The Petroleum Publishing Co. Entered as second-class matter September 1, 1910, at post office at Tulsa, Okla., under act of March 3, 1879. United States and foreign rates to the petroleum industry, 1 year $4, 2 years $7, 3 years $8.

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OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
EXPLORATION • DRILLING • PRODUCTION • FIELD PROCESSING

. . . an integrated magazine serving an integrated industry

TECHNOLOGY–OPERATION

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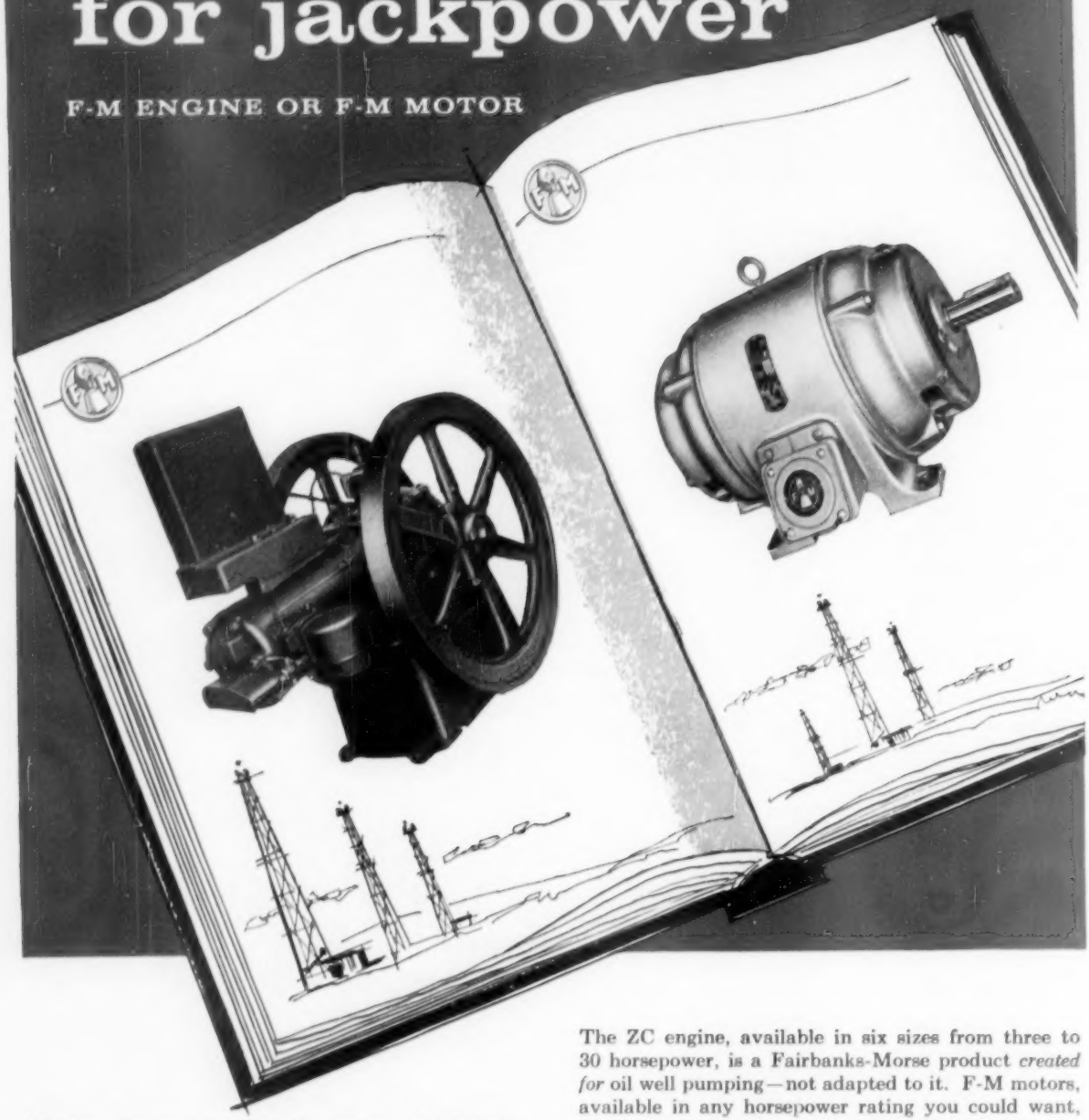
for jackpower

F-M ENGINE OR F-M MOTOR



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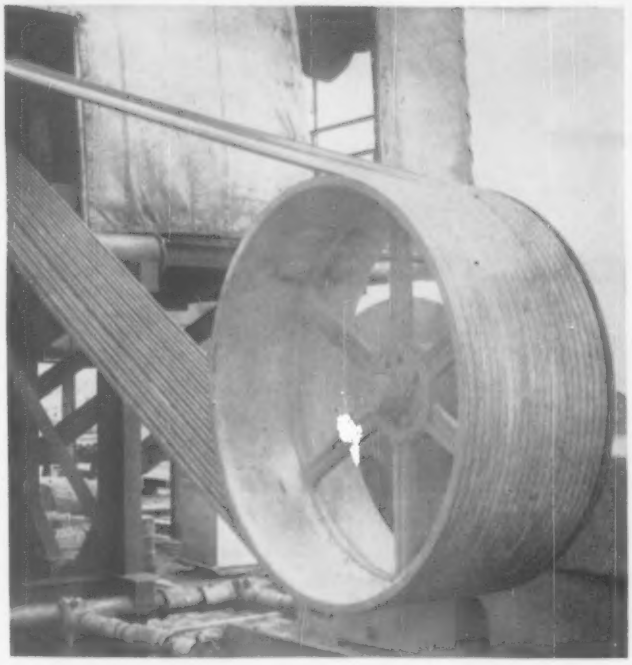


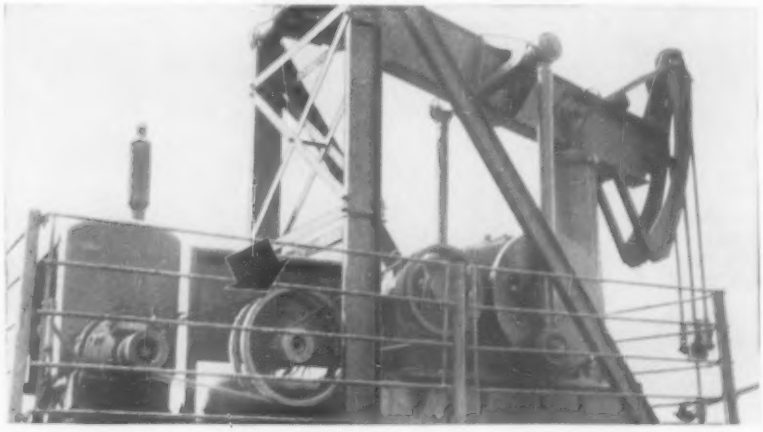
Three costly V belt problems and how they were solved

ANY man who works in the oil field knows how expensive it can be when a belt drive breaks down. Here's what happened in the case of three "problem" drives when the operators switched to an entirely different kind of belt—the Grommet V belt, made by B. F. Goodrich.

Upper left—When regular V belts were used to drive the mud pump on this rig, the power loss was high. Now Grommet V belts are used, and the tool pusher says, "They are the most positive and reliable power transmitters we have ever used." Last longer, too! On one of his rigs, a set of Grommet belts lasted 2½ years, drilled 200,000 feet of hole.

Upper right—The problem on this rig was short belt life. The tool pusher solved it by changing to Grommet V belts. At last report, the set shown here had tripled belt service by lasting 28 months.

Lower left—Every time that pump stops, the mechanism has to be pulled out of the 3000-foot well, cleaned, and put back. Some belts lasted only 3 days, others 6 weeks. Then a set of Grommet belts were tried. When the picture was taken, they'd been on 6 months, were still in good shape.



If you're not getting the belt service you should, chances are good that B. F. Goodrich Grommet V belts can solve your problem, too. They're stronger, stand shocks better, don't stretch and slip as much as other belts. And they cost no more. They're sold at leading supply stores and B. F. Goodrich warehouses throughout the oil field. *B. F. Goodrich Industrial Products Co., Dept. M-799, Akron 18, Ohio.*

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...give you more for your money in...

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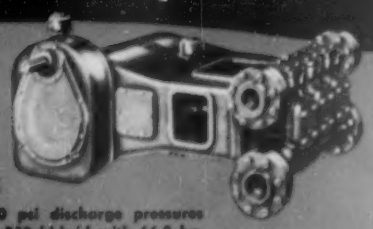
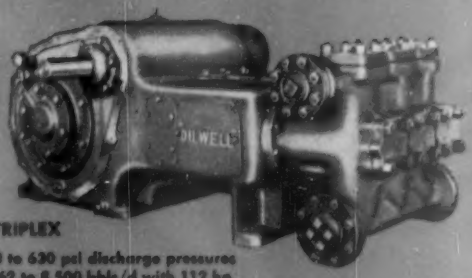
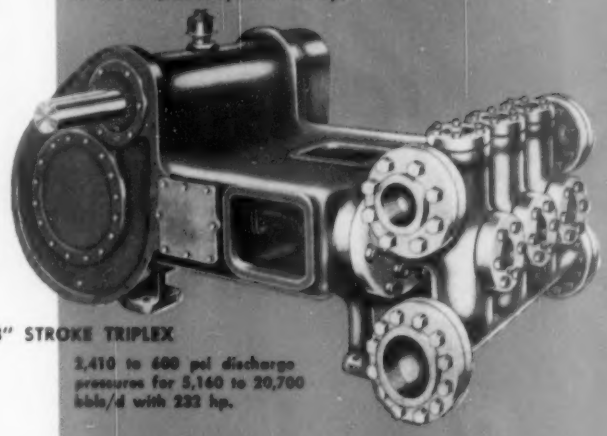


4" STROKE TRIPLEX
5,000 to 400 psi discharge pressures for 560 to 6,850 bbls/d with 66.8 hp.



6" STROKE TRIPLEX
5,650 to 630 psi discharge pressures for 462 to 8,500 bbls/d with 112 hp.



8" STROKE TRIPLEX
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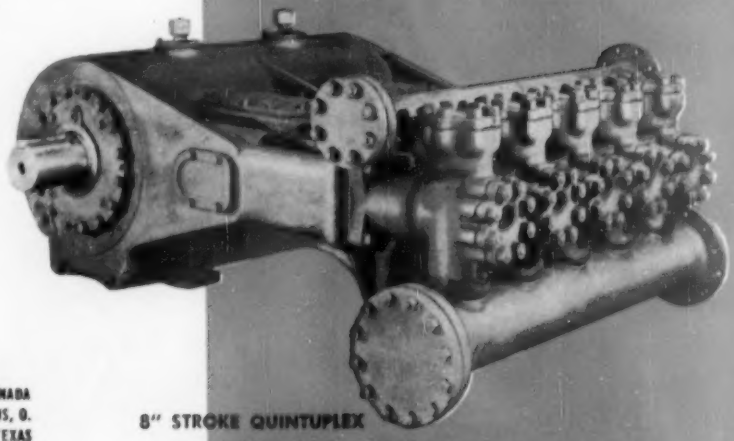

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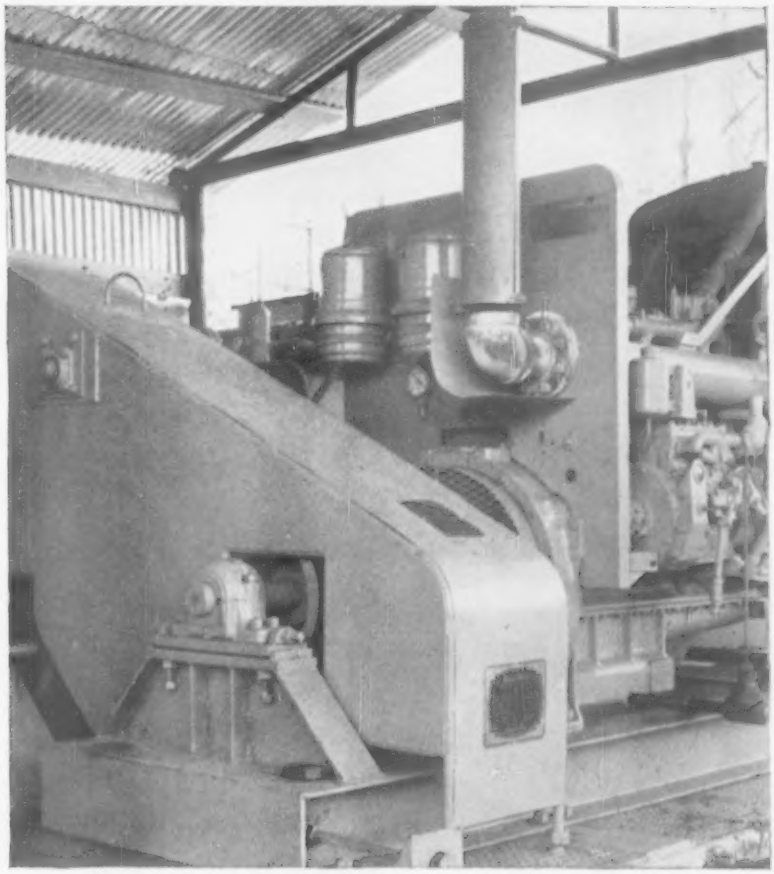
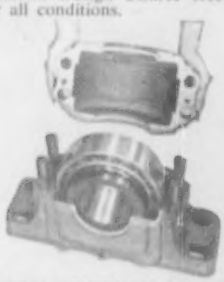


Heavy, shock loads encountered on this Wilson Supply Company 110 hp packaged gas lift twin compressor unit call for high capacity and inherent alignment — two of many features built into Link-Belt Roller Bearings.

SELF-ALIGNING ROLLER BEARING is self-contained and adjusted at the factory, needs no shims or alignment rings at installation. Design assures free rolling under all conditions.



TWO-PIECE HOUSING facilitates installation, inspection and disassembly. Both base and cap are machined as a unit for perfect match. The cap is doweled to the base for proper positioning.

CHOICE OF SEALS. Left, contact-type felt seals for grease lubrication and dirty conditions—right, spiral labyrinth steel seals for oil or grease lubrication and heat conditions.

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BRING on your sudden loads and impacts, shaft deflection and misalignment. A heavy-duty, high-capacity Link-Belt self-aligning roller bearing takes such punishment in stride . . . adjusts immediately in all directions . . . delivers a high load at relatively moderate cost.

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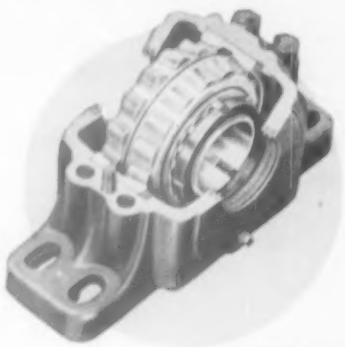
For all your bearing needs, look to industry's most complete line of ball and roller bearing blocks. At any of 40 Link-Belt offices, you can get a copy of data Book 2550. Or ask your authorized stock-carrying distributor. 13,301 B

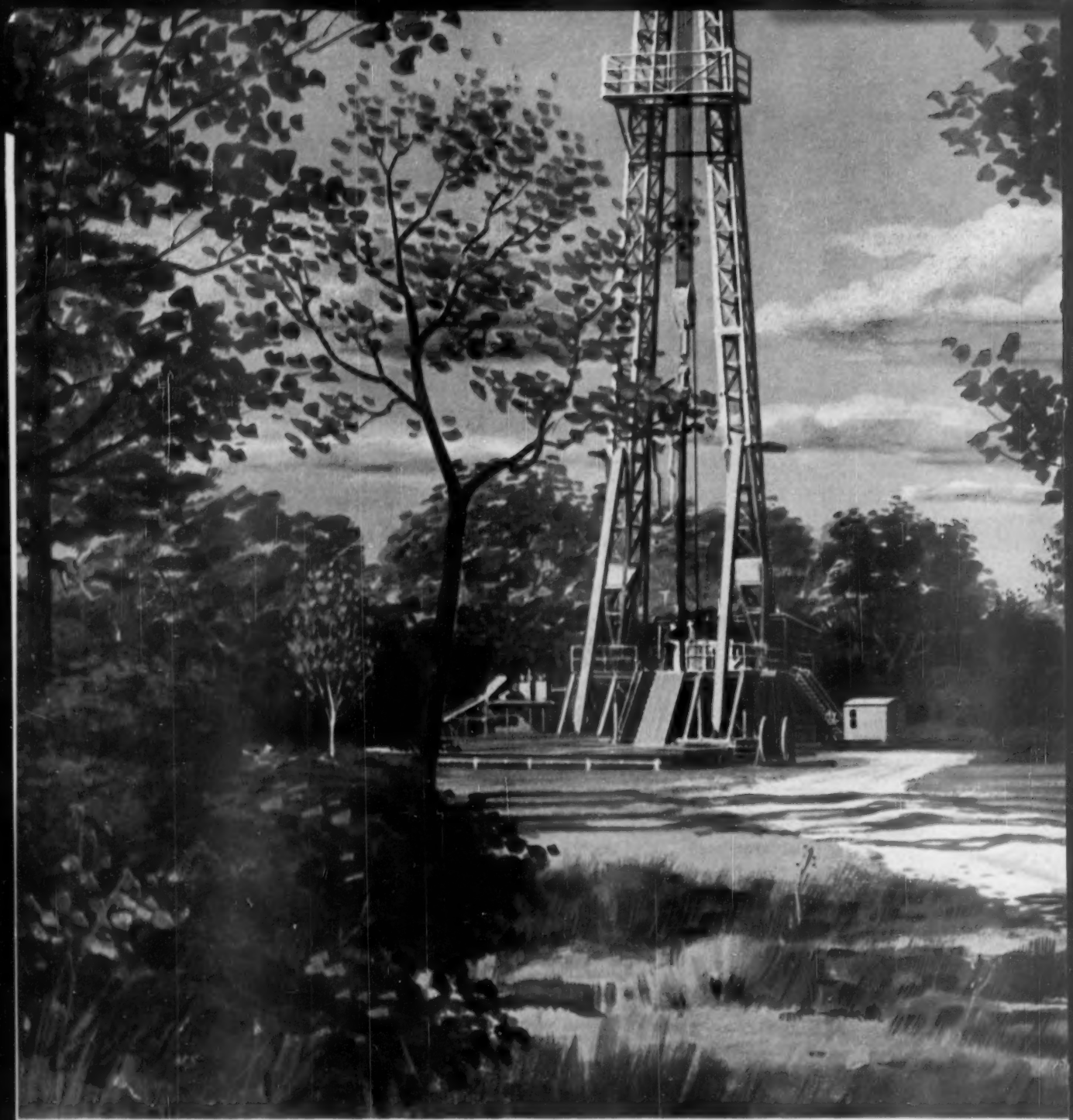
LINK-BELT

Ball and Roller Bearings



Series 6800, 6900, 7800, 7900 roller bearing blocks

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 21, Odessa, Tex., Shreveport, La., Los Angeles 33, Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields.



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The blue and white color, yes, but its true distinction results from the variety of accurate well logging and perforating services it performs on one trip to your well. More than 20 years of field equipment engineering contribute to its dependability. The Schlumberger-designed equipment in the unit . . . the well-trained personnel who operate it . . . and the competent interpretation and log analysis you receive further distinguish the Schlumberger field unit from any other in the field.

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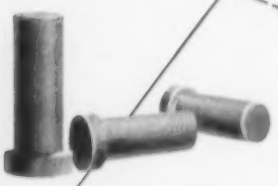

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How TIMKEN® bearings maintain rotor adjustment in versatile, heavy-duty pump

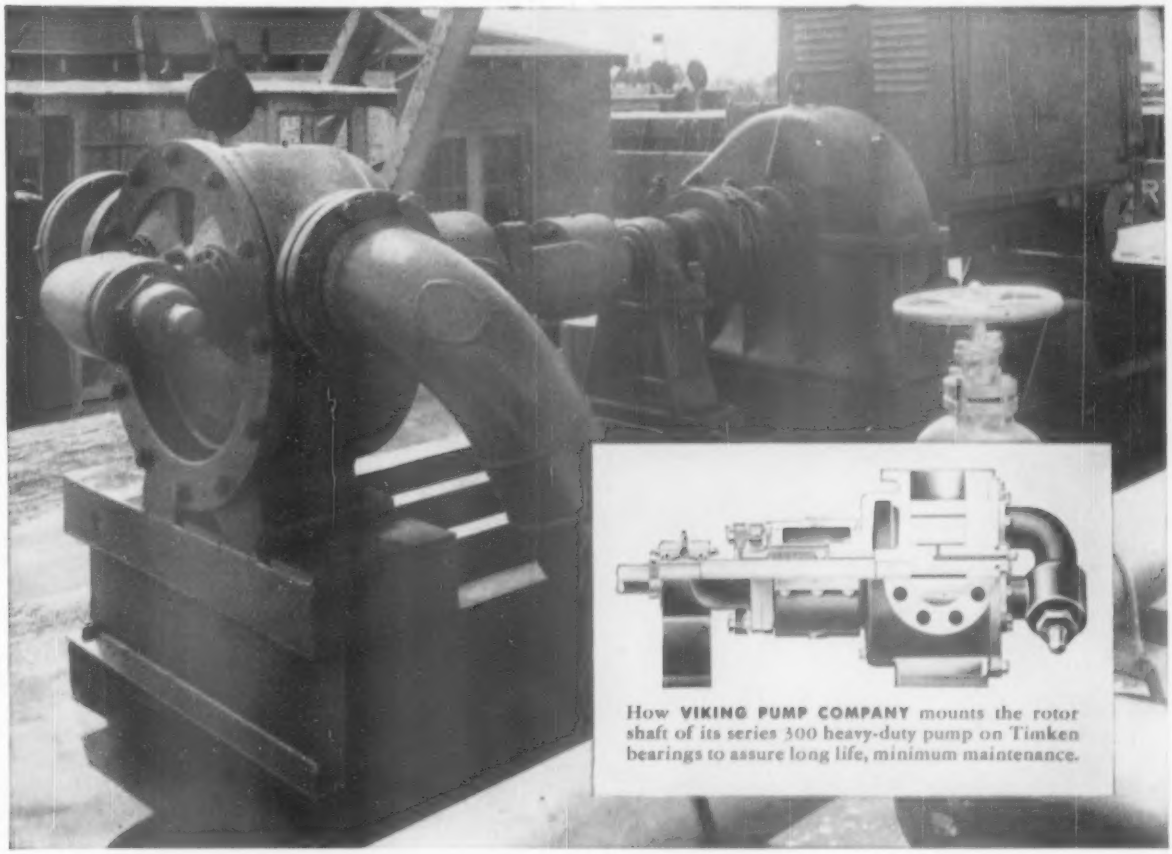
THE Viking Pump Company's series 300 heavy-duty pump was designed to give dependable performance, pumping thin or thick liquids. To make sure it delivers, Viking engineers specify Timken® tapered roller bearings for the rotor shaft.

Timken bearings provide thrust control for the large power-driven rotor shaft gear. They permit adjustments for proper end clearance and also prevent the pump rotor from wearing against the pump head. Their tapered construction lets them take heavy thrust loads as well as radial loads in any combination.

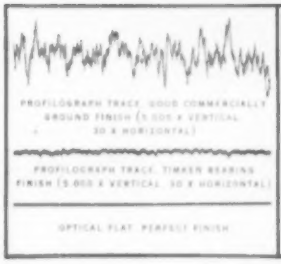
Timken bearings hold wear to a minimum because they practically eliminate friction. That's because they're designed to roll true and because they're made with microscopic accuracy to conform to their design. You're doubly assured of Timken bearings' quality because we make our own steel. No other U. S. bearing maker does.

So for long life and minimum maintenance, always specify Timken bearings. Look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



How **VIKING PUMP COMPANY** mounts the rotor shaft of its series 300 heavy-duty pump on Timken bearings to assure long life, minimum maintenance.


PROFILOGRAPH TRACE, GOOD COMMERCIALLY GROUND FINISH (5,000 X VERTICAL, 30 X HORIZONTAL)
PROFILOGRAPH TRACE, TIMKEN BEARING FINISH (5,000 X VERTICAL, 30 X HORIZONTAL)
OPTICAL FLAT, PERFECT FINISH

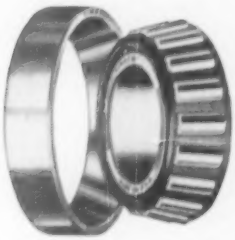
SMOOTH TO MILLIONTHS OF AN INCH

Surface finish of high quality Timken bearing rollers and races is so smooth that it takes a profilograph to measure its smoothness. This instrument measures surface variations to a millionth of an inch, as shown at the left.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST ◫ LOADS OR ANY COMBINATION

because of this spring

Johnston is tops in testing

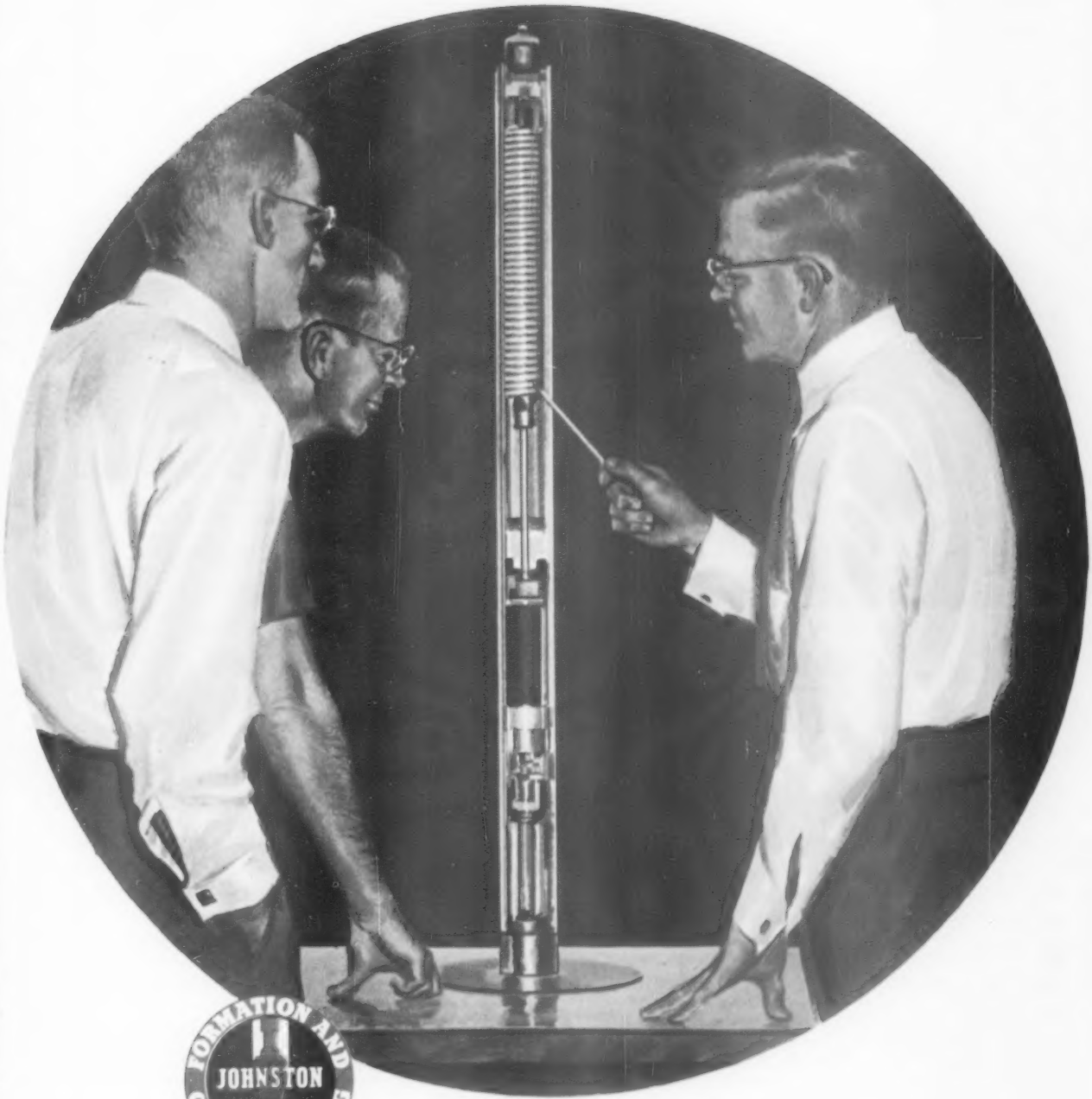
Actually, this chrome vanadium steel spring is only one of many reasons why Johnston Is Tops In Testing. A noteworthy achievement in metallurgy, its ultra low thermal coefficient and its ability to deflect up to five inches under pressure makes it the ideal tension member for pressure recording instruments. Thus, in sensitivity, accuracy, and behavior under high bottom hole temperatures, it is far superior to any other formation pressure measuring device. For example, on standard field 0-7000 psi range instruments, pressure changes of only 2½ pounds are observed continuously . . . a sensitivity of 5/100 of 1 per cent!

A rugged built-in thermometer and chronometer leave nothing for the imagination. Only a final completion can provide a more accurate productivity index.

So, why be satisfied with an approximate reservoir evaluation when Johnston Testers enable your engineers to see the true picture?

JOHNSTON

first in drill stem testing



FORMATION AND CASING TESTING
JOHNSTON

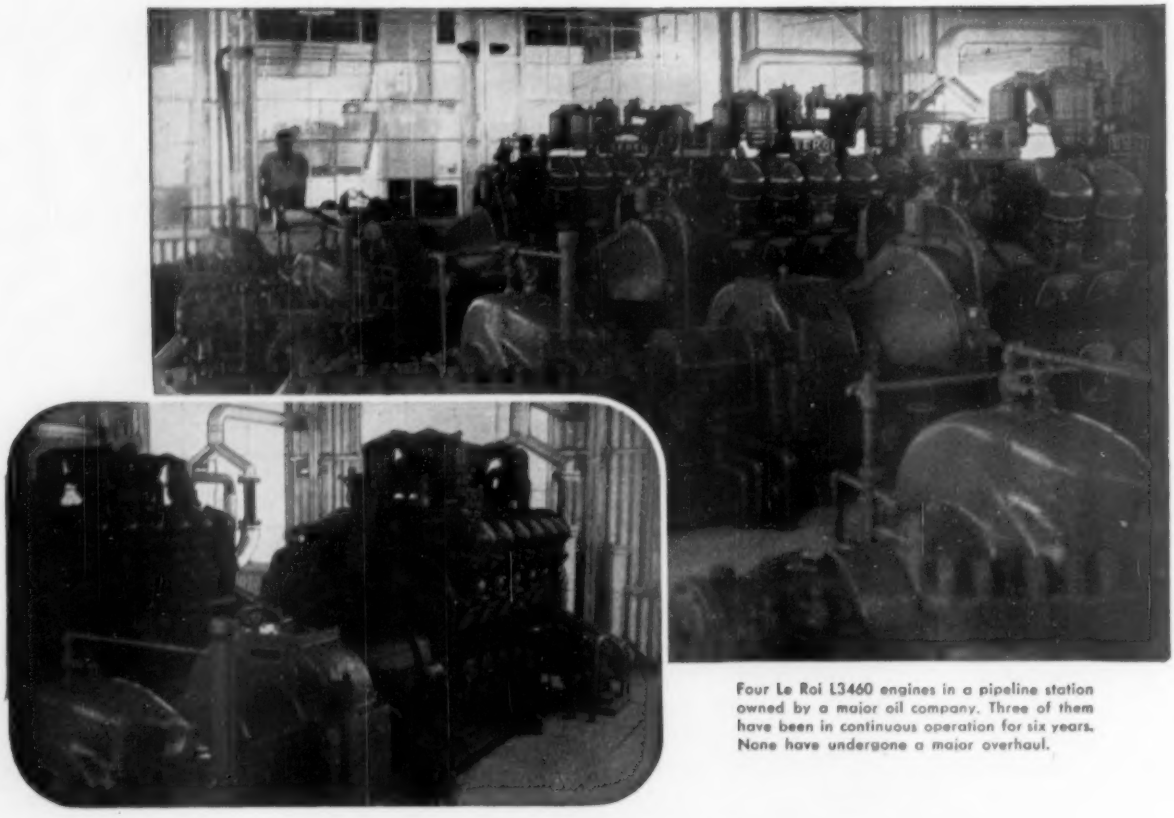
A Subsidiary of Schlumberger Well Surveying Corporation

TESTERS

P. O. BOX 98,

HOUSTON, TEXAS

LOS ANGELES, CALIF. • CALGARY, CAN.



Four Le Roi L3460 engines in a pipeline station owned by a major oil company. Three of them have been in continuous operation for six years. None have undergone a major overhaul.

Power-Packed Pipeline Station

. . . uses Le Roi L3460's to provide plenty of low-cost pumping power

Le Roi's L3460 with 600 max. hp. and its bigger brother, the L4000 with 655 max. hp., are ideal for pipeline service on many counts. Here's why:

Plenty of power with good fuel economy—These engines develop 600 and 655 max. hp. with rock-bottom fuel consumption, and can be run on natural gas, gasoline, or butane. Advanced design manifolding, low friction bearings, and low power loss to accessories, all contribute to unusual operating economy.

Long engine life—Perhaps the best proof of this statement is found in the trouble-free performance experienced by users in installations like the one shown above. Basically the L3460 and L4000 are compact, high-output engines designed with short stroke to give you greater horsepower and speed, without compromising engine life. And that's exactly what they do for you.

More comfortable operating conditions—Water-cooled exhaust manifold cuts down engine heat in operating areas, yet provides fast engine warm-up. The smooth, clean lines of these engines prevent dirt from collecting—that's why they are so easy to keep clean.

Compact V-12 design packs a lot of horsepower in a small space—to give you more horsepower per dollar. This, plus vibrationless performance, reduces foundation costs, simplifies installation.

We think that if you see an L3460 or L4000 in operation you'll agree that they provide the answer to low-cost pumping power. Have your supply house or Le Roi distributor show you one at work. Bulletins are available upon request—just write us.

P-140

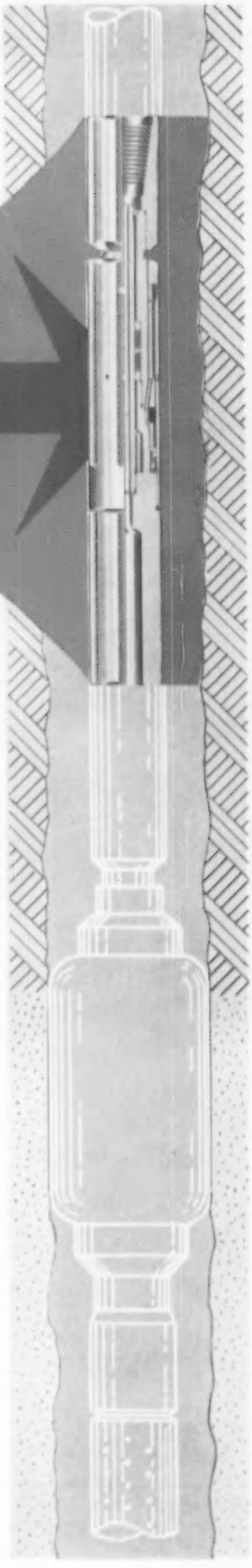
LE ROI *Division of Westinghouse Air Brake Co.*

Milwaukee 1, Wisconsin

PORTABLE AIR COMPRESSORS · TRACTAIR · STATIONARY AIR COMPRESSORS · AIR TOOLS · ENGINES

"IT'S A KNOCKOUT"

HALLIBURTON'S HYDRAULIC JAR



TO EASE THE STRAIN ON TESTING STRING

Unseating and releasing the packer or anchor on completion of drill stem tests is easier and faster with Halliburton's Hydraulic Jar, which has performed with outstanding success in several years of severe field testing. It utilizes the hydrostatic pressure of the well fluid to deliver the necessary "knock-out" punch . . . relieving strain on the testing string. Jar design, employing only one moving part, makes the operation very simple. When adjusted into the testing string, only 40 inches are added to its length.

THE DEEPER THE HOLE, THE HEAVIER THE BLOW

When a pull is applied to the pipe against resistance, the sealing packer acting as a piston in the hydraulic system of the Jar works against the hydrostatic pressure of the well fluid. After a short travel of the mandrel, the hydraulic system releases the pressure suddenly, allowing the mandrel to move freely. The tension in the pipe supplies the energy to cause the shoulder on the mandrel to deliver a blow to the stuck packer or anchor. The deeper the hole and the greater the hydrostatic pressure of the well fluid, the stronger the blow. Jar can be cocked and re-cocked again and again by slacking off pipe weight, as when Packer is set.

At Halliburton's low rates, you can actually save many times the nominal rental you pay to use Halliburton's Hydraulic Jar on your testing string. Just call your local or district office of the Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

COMPLETE DATA SENT ON REQUEST

Add this valuable information to your Halliburton Service File

HALLIBURTON TESTING SERVICE

251 SERVICE CENTERS—JUST MINUTES AWAY FROM ANY RIG

HOMCO

DESIGNS THEM

FISHING AND CUTTING TOOLS

THIS IS THE TOOL YOU SEE

THESE ARE THE TOOLS BEHIND THE TOOL

HOMCO Internal Cutter for Cutting Inside Drill Pipe Tubing and Casing.

When Fishing or Cutting Tool problems arise . . . call HOMCO. Behind each tool manufactured in HOMCO's plant is a corps of trained engineers, working around the clock designing, engineering and developing fishing and cutting tools to meet any emergency operation in the field.

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509 Madison Avenue
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THE WORLD'S LARGEST INDEPENDENT OILFIELD SUPPLY AND SERVICE ORGANIZATION

DIRECTIONAL DRILLING
FISHING AND CUTTING
OILFIELD SUPPLIES
ELECTRICAL WELL SERVICE

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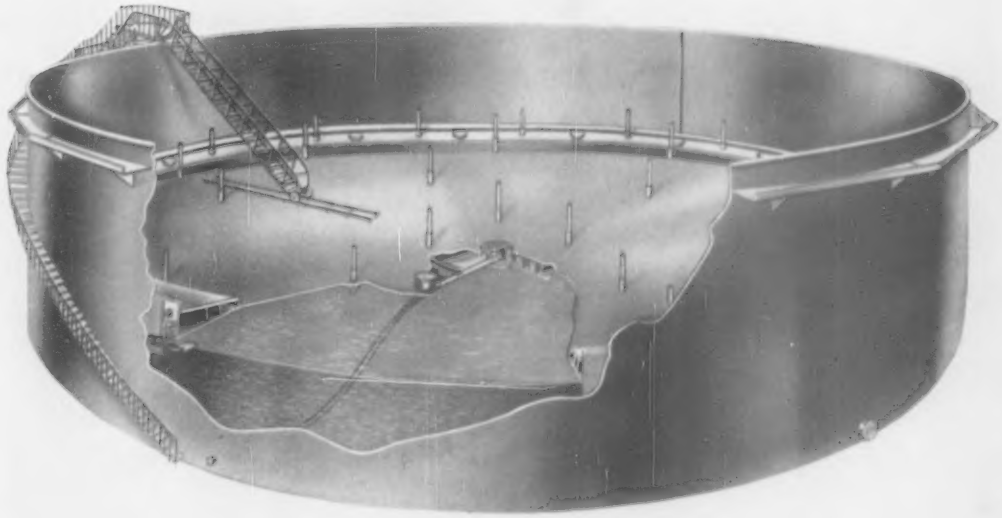
HOUSTON OIL FIELD MATERIAL COMPANY Inc.

HOUSTON, TEXAS

RESEARCH ENGINEERING MANUFACTURING DEVELOPMENT

GRAVER®

WE'VE CLEARED THE DECK...



STABLE . . . because, ship-like, the center of buoyancy is below the center of gravity.

CORROSION-RESISTANT . . . . because the liquid in storage is in full contact with the deck.

SELF-DRAINING . . . rainfall flows to the Graver sump at the center low point of the roof.

VAPOR-STOP SEAL . . . Graver's patented single seal . . . proved effective against vapor loss.

. . . FOR A NEW, LOW-COST FLOATING ROOF TANK WITH UNDER-DECK CENTER WEIGHT

Here is another outstanding Graver first in single-deck floating roof tanks. We've cleared the deck for easy snow removal and positive drainage by putting the center weight *below* the deck. This effects additional economies in construction without sacrificing the long-established advantages of Graver's patented single-deck floating roof principle and characteristic Graver quality. This new Graver floating roof tank (both pontoon and pan type) has been thoroughly proved by installations across the nation. May we give you complete details?

GRAVER®

GRAVER TANK & MFG. CO. INC.

EAST CHICAGO, INDIANA • NEW YORK • PHILADELPHIA • EDGE MOOR, DELAWARE
PITTSBURGH • DETROIT • CHICAGO • TULSA • SANDS SPRINGS, OKLAHOMA
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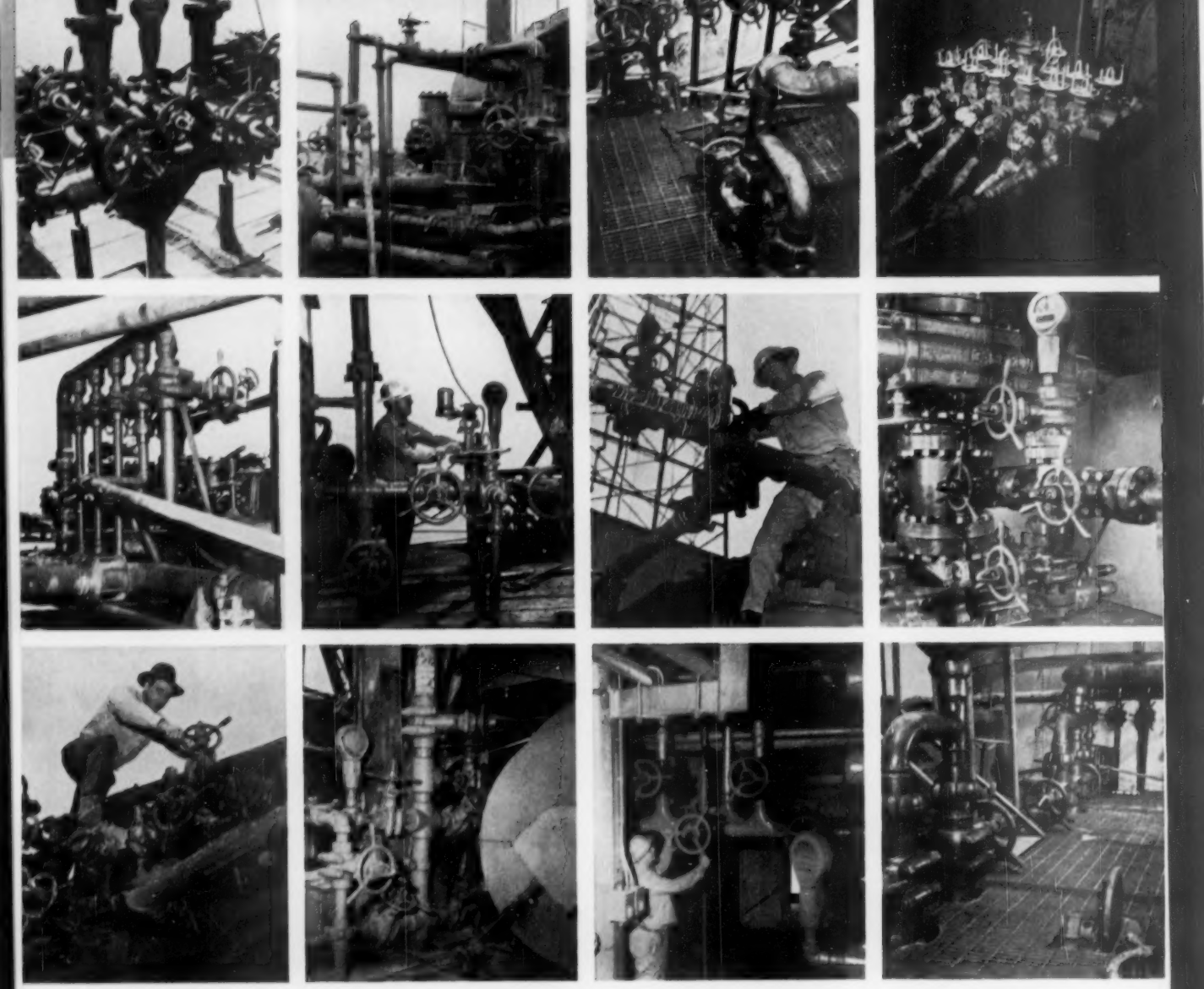


There is one best Mud Valve . . . FLEX-SEAL

proven a million times or more!

You would naturally expect the people who have had most experience with resilient seals to come up with the best practical solution to the mud valve problem. That is just what Cameron did, years ago.

Drawing on a vast backlog of experience with resilient seals for blowout preventers, master drilling valves, and wild well capping manifolds, Cameron engineers perfected the Flex-Seal Valve for mud lines. It was accepted immediately, and mud manifold maintenance the world over took a nose dive.

The reason? No other valve is quite as rugged. No other valve may be relied upon to operate freely and seal tightly after long and severe service. No other valve may be repaired at such low cost.

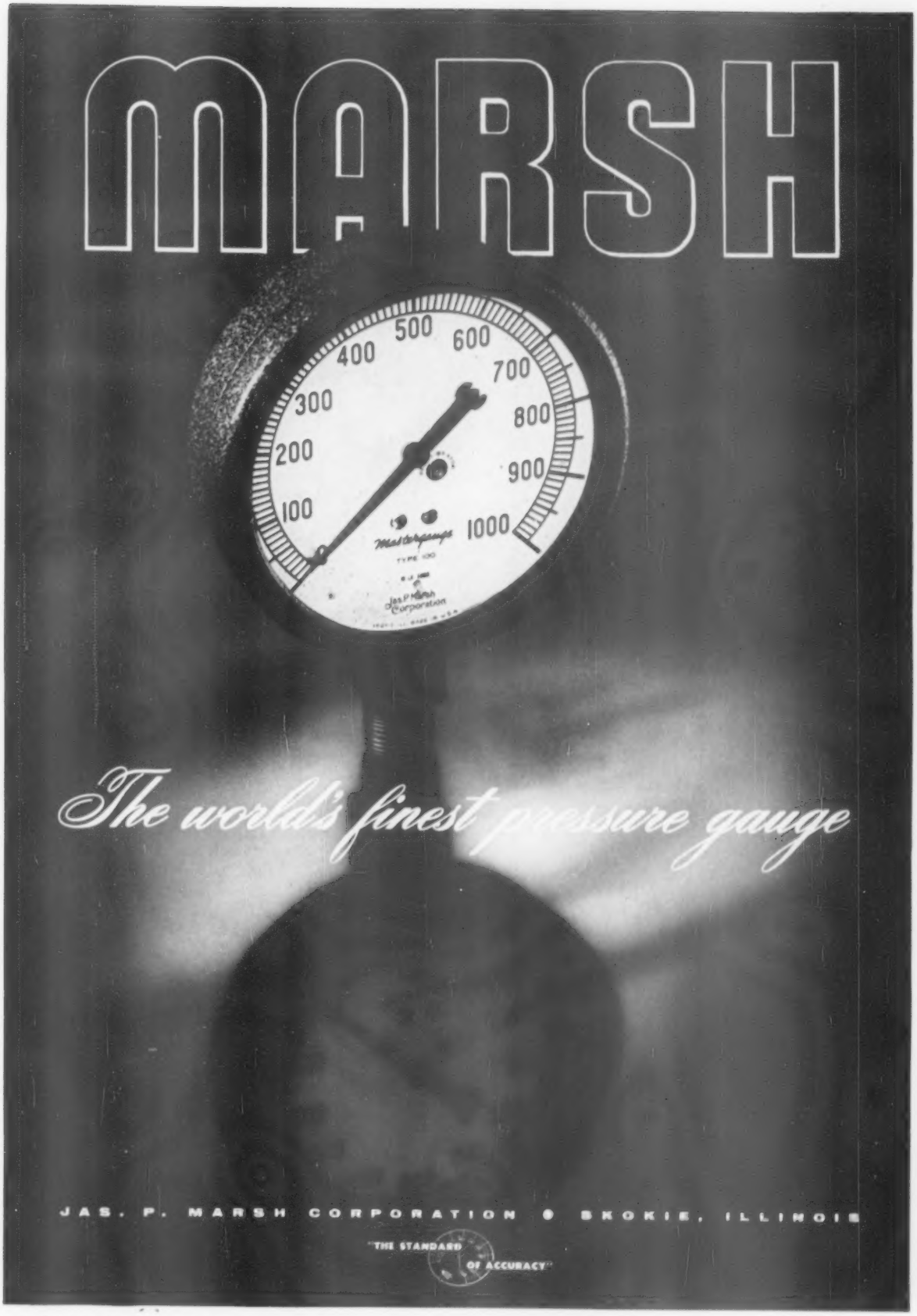
The Flex-Seal Mud Line Valve was not designed for obsolescence. Someday, if a better mud line valve is built, it will come from Cameron . . . specialist in producing equipment for the control of well pressures and drilling costs!

Cameron

IRON WORKS, INC.

P. O. Box 1212 - Houston, Texas

Export Office: 7912 Empire State Bldg., New York City. In England: Cameron Iron Works Ltd., Time & Life Bldg., New Bond Street, London W. 1 England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The world's finest pressure gauge
JAS. P. MARSH CORPORATION • SKOKIE, ILLINOIS
"THE STANDARD OF ACCURACY"

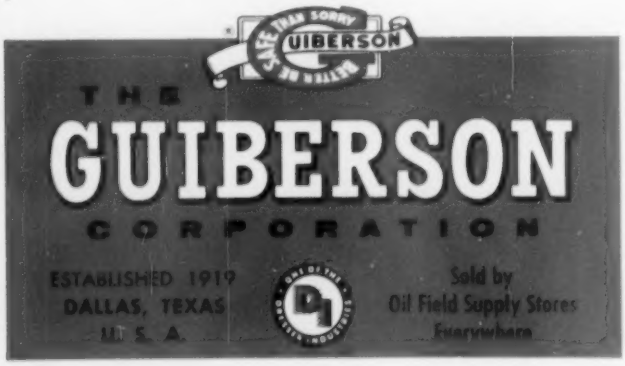
GUIBERSON DRILL PIPE PROTECTOR RUBBERS

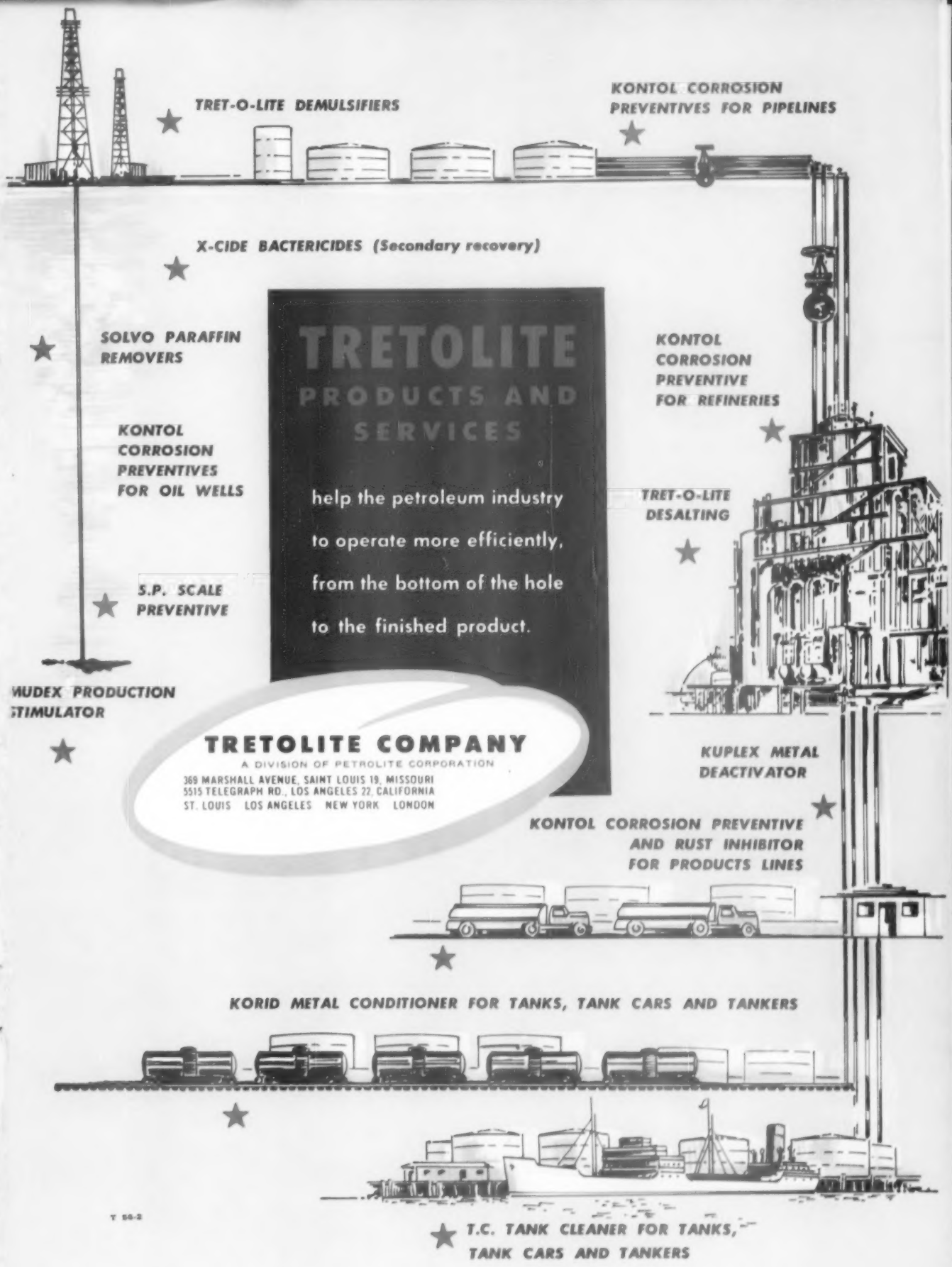
Stay Put.. Keep Their Grip.. Keep Their Size..

Guiberson drill pipe protector rubbers show their quality when we first put them on your pipe. And in the hole, they *stay put.* They can work in high temperatures or in oil base drilling muds— take a powerful amount of wear and abuse. *They keep their grip.*

You get extra casing protection and extra performance from Guiberson protector rubbers because they're made from a special wear-resisting rubber compound, designed for universal application in all kinds of drilling. And you get it because Guiberson just plain *knows how* to mold and compound rubber products that can take the tough jobs in today's wells — and lick them.

That extra rubber know-how comes from Guiberson's long years of experience in manufacturing rubber products specifically for the oil industry. It comes from a rubber plant and laboratory staffed and equipped to do the specialized job right. When you want drill pipe protectors that won't walk and do maintain their original OD for a long, useful life, look to Guiberson for the answer.




TRET-O-LITE DEMULSIFIERS
KONTOL CORROSION PREVENTIVES FOR PIPELINES
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SOLVO PARAFFIN REMOVERS
KONTOL CORROSION PREVENTIVE FOR REFINERIES
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MUDEX PRODUCTION STIMULATOR
KUPLEX METAL DEACTIVATOR
KONTOL CORROSION PREVENTIVE AND RUST INHIBITOR FOR PRODUCTS LINES
KORID METAL CONDITIONER FOR TANKS, TANK CARS AND TANKERS
T.C. TANK CLEANER FOR TANKS, TANK CARS AND TANKERS

TRETOLITE PRODUCTS AND SERVICES

help the petroleum industry to operate more efficiently, from the bottom of the hole to the finished product.

TRETOLITE COMPANY

A DIVISION OF PETROLITE CORPORATION

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SAVE 2 WAYS WITH

MARTIN RUBBER GUIDE CAGES

1. GREATER PRODUCING PROFITS *because:*

Martin Cages last much longer. The oil-proof rubber guides do the trick, by absorbing the ball peen hammer action of the hard balls. They also have superior resistance to sand abrasion. And they can be replaced.

2. GREATER PRODUCING PROFITS *because:*

Ball & Seat life is usually doubled, on the average. With the rubber guides, there is much less chattering, chipping and pitting. Ball falls true on seat. Such improvement in Ball & Seat life eliminates a lot of pulling expense.

In the last year alone, new users of Martin Cages have increased by 85%. The word is getting around. More and more economy-minded producers are learning about the advantages of the Martin Cages! . . . Manufactured in open and closed types . . . all diameters and styles. Write for John Martin Catalog No. 4 today. *Martin Cages are available through all supply stores.*

JOHN N. MARTIN

Manufacturer

9 W. BRADY • TULSA, OKLA.

Your choice of normal or low starting current...

with Performance-Rated

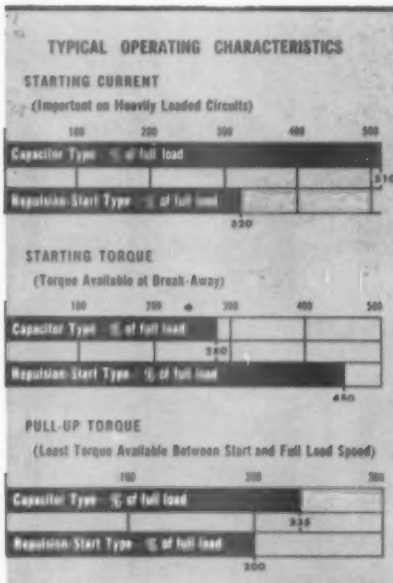
Century

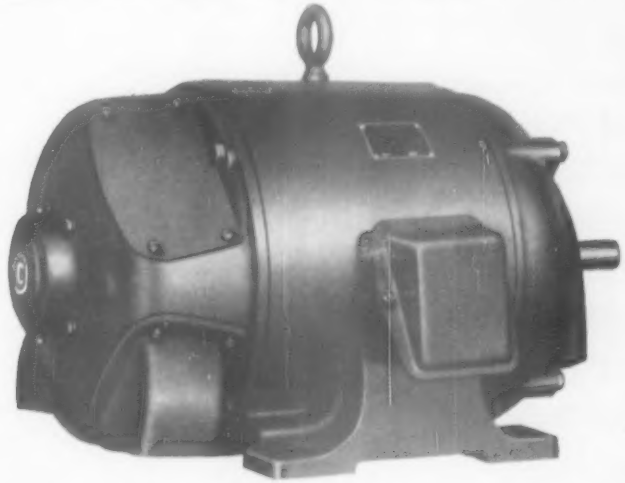
SINGLE-PHASE, HIGH TORQUE MOTORS FOR OIL FIELD USE

Capacitor Motors . . . ⅛ to 20 H.P. provide high starting torque, high pull-up torque and require normal starting current. They are available in drip proof, dust proof and explosion proof enclosures.

Even if you have severe starting current limitations, you can select the torque you need for sure starts and smooth pull-up to speed from the Century Performance-Rated Single-Phase line (see bar chart below for operating characteristics of two types of Century Single-Phase Motors).

Whatever Your Oil Field Motor Job . . . there's a Century Motor Performance-Rated to handle it with top effectiveness. For added outdoor protection, Century *Weather-Gard* Motors have openings screened to keep out rodents. Check with your supply store, or Century branch office.





Repulsion Start, Induction Motors (type RS) . . . ½ to 7½ H.P. provide very high starting torque, yet require unusually low starting current. They are available in drip proof and splash proof enclosures.

Performance-Rated© Motors ⅛ to 400 H.P.

CENTURY ELECTRIC COMPANY

CE-32

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your "rolling pipe line"

More than 2600 Olin Mathieson tank cars are in service every day shuttling between a score of production points and our customers to assure dependable delivery of Mathieson Chemicals.

In a sense, they form a "pipe line" connecting major consuming and producing areas. And, they perform the important function of balancing out local shortages and surpluses.

If you're ever caught short of an essential chemical raw material, the flexibility of a multi-plant producer can prove invaluable. Our "pipe lines" carrying caustic, chlorine, ammonia, sulphuric acid, methanol and organics may be the answer to your supply problems. Talk it over with an Olin Mathieson representative soon.

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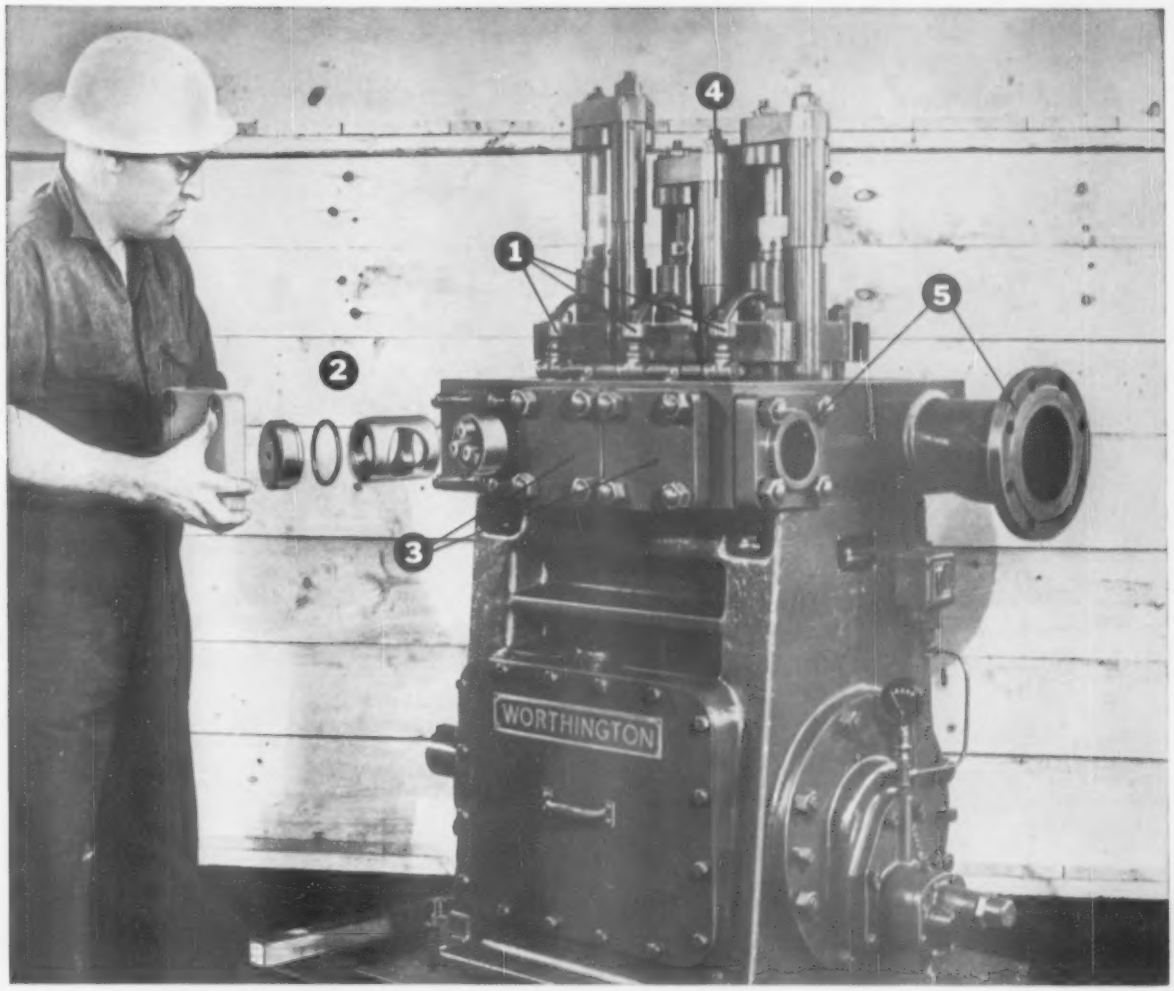


Check These 5 Waterflood Pump Features

Compare with any other! Operates for years at peak efficiency; easy to work on in the field.

Men who run waterflooding operations say the ideal pump should be (1) rugged—to operate continuously for five to ten years, (2) dependable—for peak efficiency and (3) highly accessible—for fast maintenance.

See for yourself how Worthington's waterflood pump—with five exclusive features—measures up.

It licks corrosion. Barrels are protected by exclusive feature #1—*separate drains* which carry off stuffing box leakage and prevent it from accumulating on cylinders. The cylinder is made of forged steel (or aluminum bronze) which is rugged enough to stand up for years under corrosive oil field salt water, regardless of pressure.

A Worthington pump is dependable for peak waterflood efficiency. It will run at reasonably low suction heads without rough or noisy operation because of feature #2, *double ported valves* which give greater flow through a given seat diameter.

And it's easy to work on in the field. *Individual valve covers*, feature #3, permit you to inspect and service valves in half the time (without breaking pipe connections). *Interchangeable stuffing box barrels*, feature #4, let you change pump capacity in less than an hour. *Flanged suction and discharge* openings, feature #5, make piping easy to connect or disassemble.

Add them up. For a rugged, dependable, accessible waterflood pump, your choice has to be . . . Worthington! Get the full story from your nearest Worthington District Office, or write to Section P61, Worthington Corporation, Harrison, N. J. P-6.1

WORTHINGTON

Christmas Tree Roots

Who can say when and where an idea is born? Creative design engineers don't work by the clock. Their scratch pad is more often the back of a napkin or a scrap of paper. They think and talk shop all the time.

Perhaps these engineers are talking about last weekend's catch.

Fishing conditions in the Gulf of Mexico have nothing to do with the Oil Center Tool Company necessarily, or Christmas Trees.

But the point is, tomorrow's coffee break may see these same scientists discussing an idea. It will be an idea that someday may have a direct bearing on how you will complete your well or produce your oil and gas.

Christmas Trees aren't born in a machine shop . . . they're born in the minds of men.

That's why the Oil Center Tool Company places so much emphasis on minds . . . that's why O-C-T emphasizes research and engineering.

Roots of O-C-T trees go deep—miles into the earth, as a matter of fact.

But, there is another depth which is the real reason for the stability of O-C-T—depth of research and development.

The need for efficient, economical well control equipment stamped "O-C-T" that is being used so widely in the oil patches today was anticipated long before that need became critical.

The idea for much of this equipment was born . . . the seed sown . . . perhaps at a coffee break.

But, ideas aren't transmitted directly to the machine shop.

These have a long gestation period.

Many months of laborious paper work, model experimentation and testing are necessary before an O-C-T product makes its debut in an oilfield.

Design must be right . . . the product must be right.

O-C-T has pioneered many improvements, many completely new designs, in the area of well control equipment. The company's list of "firsts" is long.

This "first thirst" that is part of the spirit of O-C-T is always being slaked by experienced engineers . . . by imaginative researchers . . . by practical development men.

These men know the oil industry. They know its problems.

More than that, they have the ability to plan for the future, to anticipate problems of tomorrow.

The best in oilfield equipment is being turned out in O-C-T shops.

And the best in oilfield equipment to solve difficult problems in the future is being turned over in the minds of men . . . being charted on design boards.

Seeds originate at O-C-T.

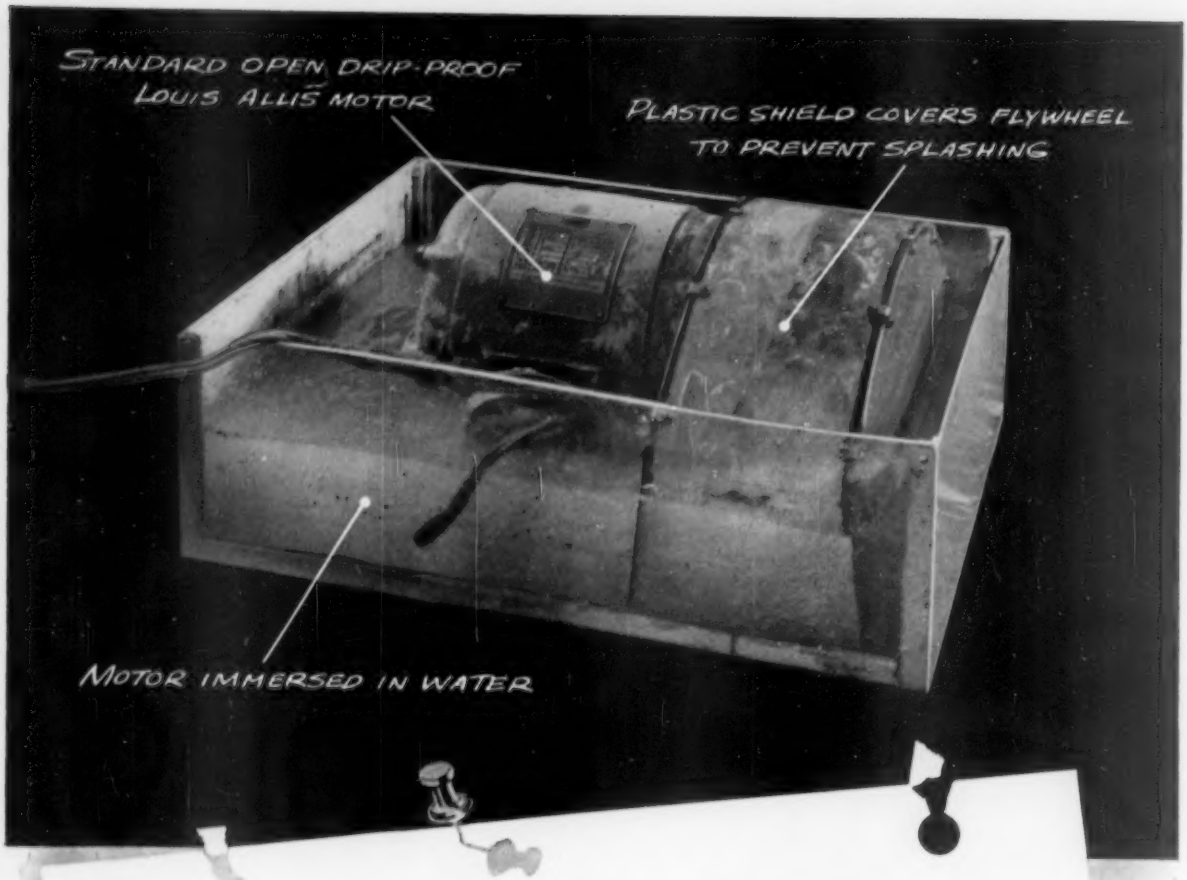
And they're sown there . . . cultivated there.

The harvest is yours!

O·C·T

OIL CENTER TOOL CO.

Export Representatives: South America — East West Oiltools, C. A., Del Lago Hotel, Maracaibo, Venezuela. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.



In water 1½ years...still running

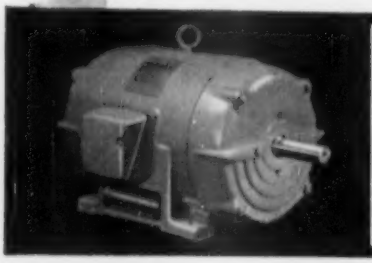
Dramatic proof that Louis Allis motor insulation provides unusual moisture resistance

We wouldn't do this to a motor. But somebody did, to check our new insulation. They took a standard open drip-proof motor, placed it in water up to the shaft, and ran it a year and a half.

The motor will still run, too, which proves that our insulating materials are of top quality. One of our exclusive features is the new phenolic impregnating varnish we use. As you can see, this varnish resists moisture, but it also has excellent thermal and chemical resistance and is not susceptible to embrittlement.

Insulation usually determines the life of a motor. That's why the insulating materials used in the new L. A. line are the product of years of continuous research and development. That's why Louis Allis motors run longer . . . give less trouble.

Find out the many other advantages available to you in the new L. A. line of motors. Write for our new bulletin No. 1700.



A complete line of standard rerated motors in frames 182 through 326U now in stock. Special rerated motors are available on short delivery.

LA-107

THE LOUIS ALLIS CO.
MILWAUKEE 7, WISCONSIN

Armco Welded Steel Pipe is widely used for gas gathering systems, gasoline plant piping, residue gas lines, transmission lines and conduit pipe.

How to get the most pipeline mileage for your money

With Armco Steel Pipe you get all the pipeline mileage you pay for. There are 132 different combinations of diameter and wall thickness to help meet your requirements exactly. You never need to compromise with the "next larger size."

You save, too, by ordering Armco Pipe in standard 50-foot lengths instead of the usual 40-foot or double random lengths. This means at least 20 per cent fewer field joints and you have fewer sections to handle.

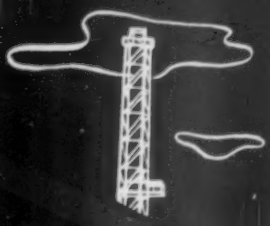
Use Armco Welded Steel Pipe for requirements in the Natural Gasoline and Natural Gas Divisions and wherever else you need dependable line pipe.

Write us for information. Armco Drainage & Metal Products, Inc., Welded Pipe Sales Division, 4876 Curtis Street, Middletown, Ohio. 201 KOME Building, Tulsa, Oklahoma. Subsidiary of Armco Steel Corporation. Export: The Armco International Corporation.

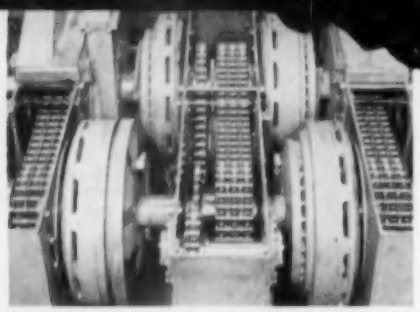
ARMCO
Welded Steel Pipe

ARMCO®

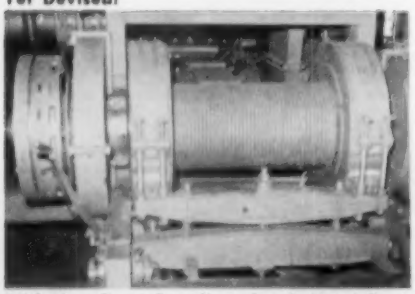
THE ALL NEW Wilson super giant rig



be modern-
buy Wilson



- *With New Three Speed and Reverse All Friction Clutch Transmission.*
- **Available with Parkersburg 22" Single Hydromatic Brake Mounted on Transmission *with 6 Speeds Between Drum and Brake* — The Best Hydromatic Brake Arrangement Yet Devised!**



- **With New Beam Equalizer, Single Nut Adjustment Lever Type Brake which CANNOT KICK.**
- **Oil Bath Drum Drive Chains Outside Frame.**
- **High and Low Clutches on End of Drum Shaft.**
- **Heavy Plate Chain Cases and Covers.**

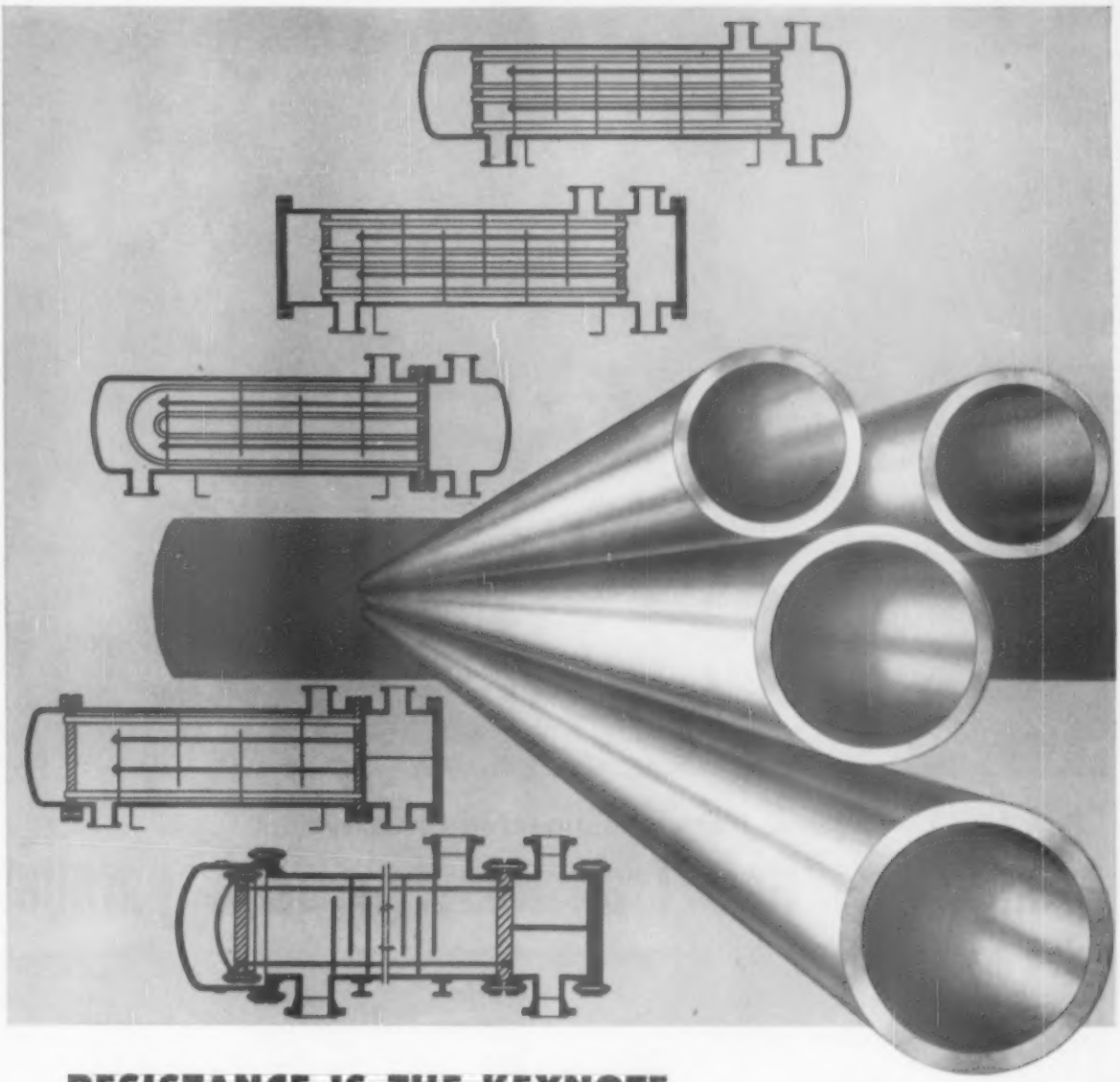
unquestionably...the most advanced and modern rig in the world today

YOU OWE IT TO YOURSELF TO INVESTIGATE
THIS NEW AND MODERN RIG BEFORE BUYING

Write for Full Details

WILSON MANUFACTURING CO., INC.

WICHITA FALLS, TEXAS • the home of RED IRON



RESISTANCE IS THE KEYNOTE

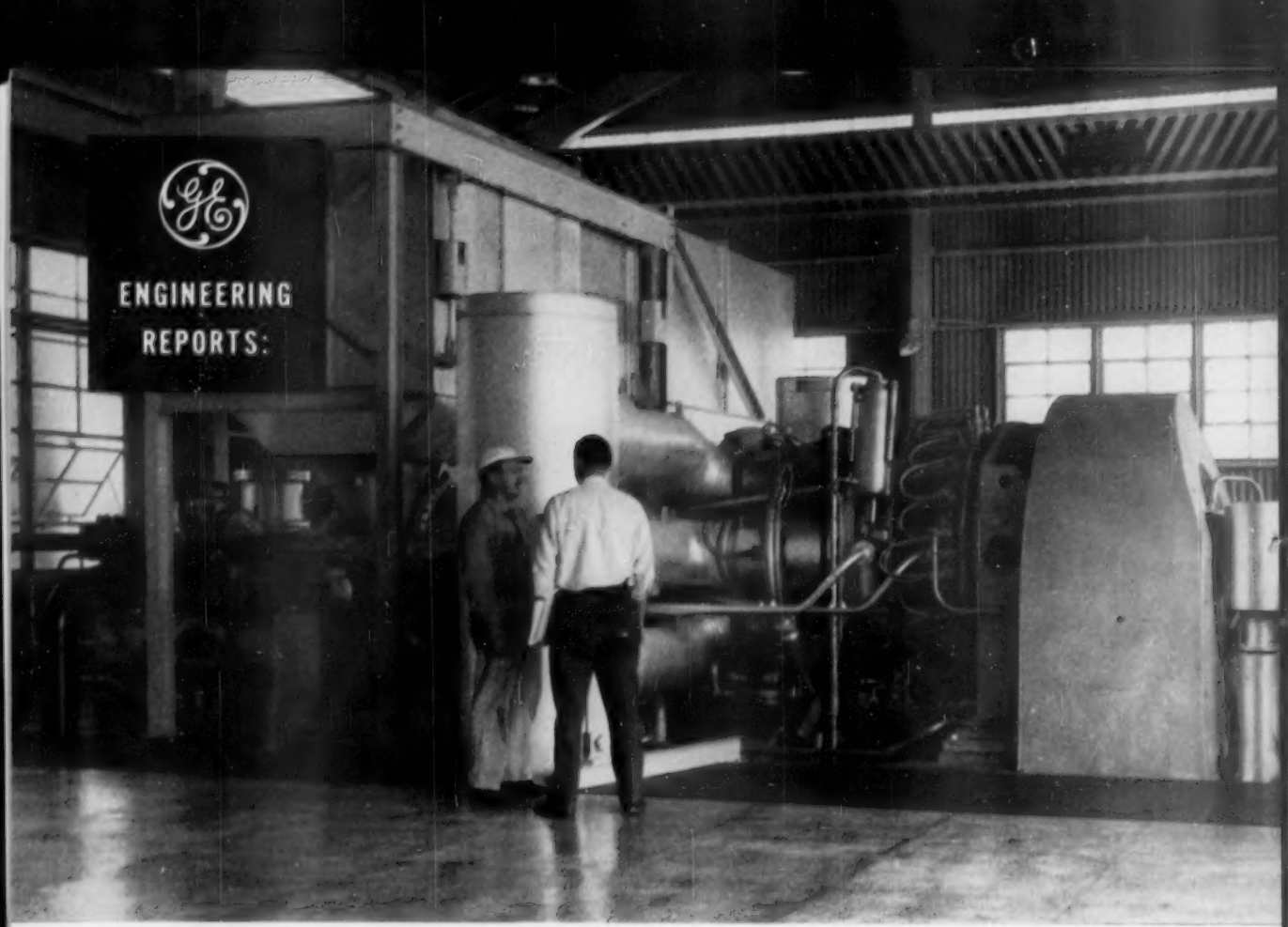
Resistance to corrosion and contamination of product is the job of B&W Condenser and Heat Exchanger Tubes in the process industries. In myriad processes where resistance to these factors is a major consideration, selection of the best tube steel analysis for optimum performance is of paramount importance in any application.

B&W offers a wide variety of grades, seamless or welded, to meet virtually every requirement, economically and dependably. In addition to designers' preferences, shop men like B&W Tubing because they know from experience that B&W Tubes are easy to bend, to roll in, and to weld.

B&W Condenser and Heat Exchanger Tubes are included in the comprehensive warehouse stocks of many helpful, well-informed independent B&W tubing distributors. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

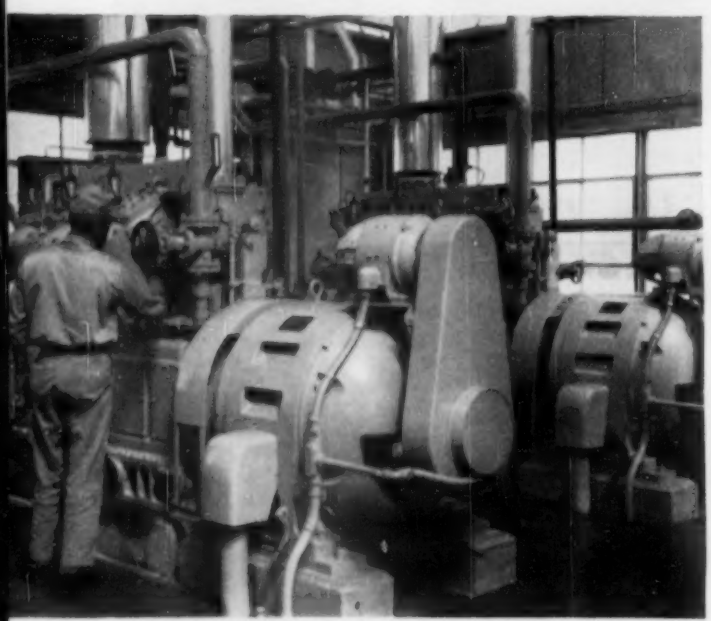
TA-6098-GP

Seamless and welded tubular products, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels

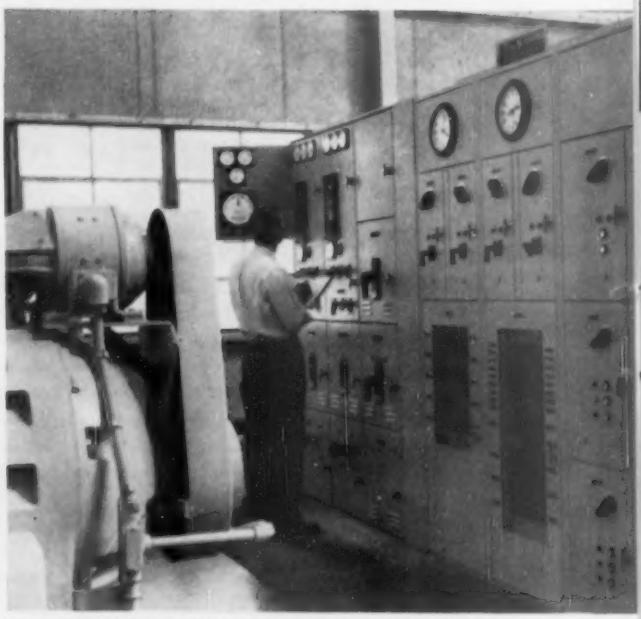


Powered by General Electric engineered drive system . . .

Tennessee Gas Transmission uses parallel

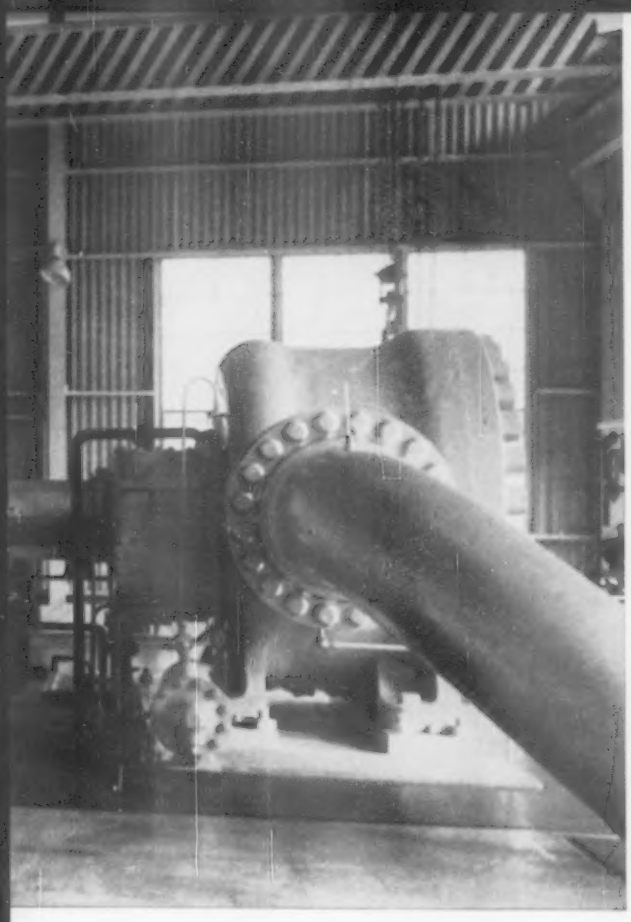


AUXILIARY ELECTRICAL equipment receive power from two General Electric 187-kva, engine-driven, a-c generators which supply 480-volt, 60-cycle power for the station system.



COMPACT, FACTORY ASSEMBLED General Electric Cabinetrol* panel centralizes control of station's auxiliary equipment, was planned to take up minimum valuable floor space.

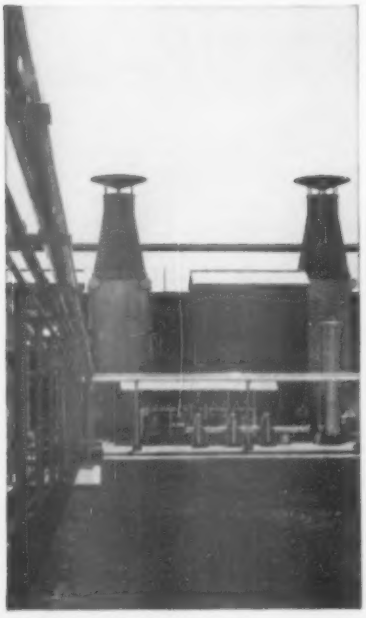
*Reg. trade-mark of General Electric Co.



CENTRALIZED CONTROL for the 2 General Electric gas turbines is located in accessible, duplex control panel. Panel provides semi-automatic operation, requires little supervision.

PARALLEL COMPRESSOR ARRANGEMENT, first in the industry, permits two 6700-hp gas turbines to handle station's prime mover requirements for 4-season, lower cost operation.

compressor arrangement in Morehead station



TURBINE EFFICIENCY is increased with regenerators, located outside new station, that "recapture" exhaust heat.

General Electric engineered compressor drive system, with two 6700-hp gas turbines, helps lower new station's operating costs

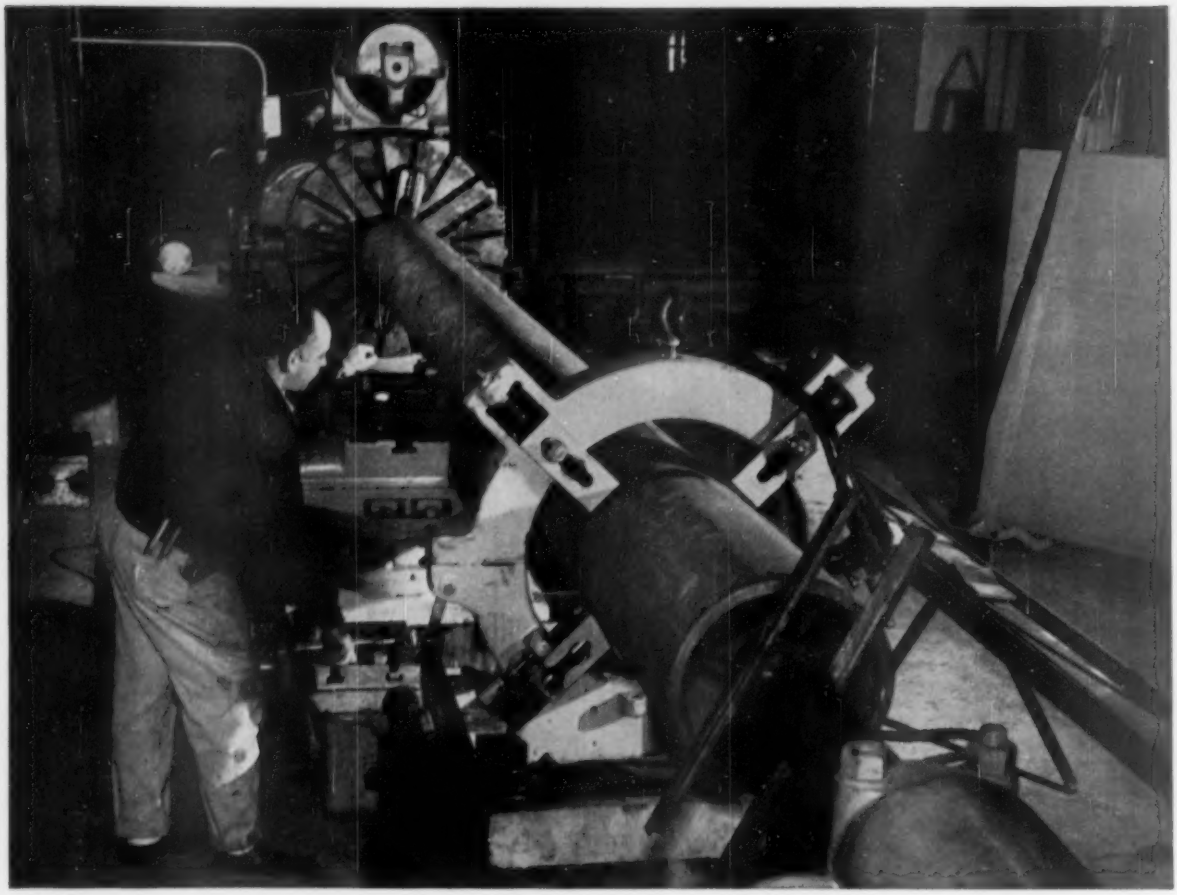
The Tennessee Gas Transmission Company's new Morehead, Kentucky, pipeline station has two centrifugal compressors arranged for parallel flow, to provide highly flexible operation. With this arrangement—an industry first—the adjustable speed compressors provide a wide range of flows and piping combinations with high stability.

THE DRIVE SYSTEM was installed to meet the station's individual compression requirements and to help lower operating costs. Speed adjustment of the turbines, to meet seasonal increases in compressor load, is easily accomplished. The station has lower maintenance and operator requirements. In addition, the gas turbine fundamental characteristic of increasing horsepower, with decreasing ambient temperature, means that up to 25% more horsepower is available to meet cold weather's increased load requirements.

WHEN YOU EXPAND your compressor facilities, General Electric has a complete line of engineering services also available to you, to help you and your consultants install a drive system engineered for your particular requirements. Your Apparatus Sales Representative, at the nearest General Electric Apparatus Sales Office, will give you complete information. Contact him early and write for bulletin GEA-5962 to General Electric Co., Section 661-54, Schenectady, N. Y.

Engineered Electrical Systems for Pipeline Pumping

GENERAL ELECTRIC



ALCO FACILITIES ASSURE VALUE IN PREFABRICATED PIPE

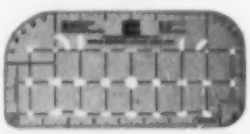
Machines and Methods at ALCO's Plant Handle All Sizes of Seamless Pipe, Any Alloy or Grade; Modern Welding Techniques Used for All Materials.

ALCO brings to prefabricated pipe production a modern plant, completely equipped with machine tools to handle any size, alloy or technique. Facilities include large lathes *(above)*, other heavy machine tools, induction heat-treating for joint preheat and stress relief after welding.

Advanced quality control methods are another important factor in ALCO prefabricated pipe. Use of X-ray machines and cobalt 60 pills to test welds is an example of up-to-date inspection and test procedures.

Experience and production know-how are also factors in ALCO prefabricated pipe. Pipe manufacture draws on welding techniques which have placed ALCO in a leading position in the welding field. ALCO's experience in heat-exchange equipment, both refinery and power plant, aids in piping manufacture.

Your inquiries on ALCO piping will receive prompt handling at any ALCO Sales Office, or, if you wish, write P. O. Box 1065, Schenectady 1, N. Y.



Information on how to obtain the ALCO piping drawing layout template, a definite aid in making piping layouts, is available from ALCO, P. O. Box 1065, Schenectady 1, N. Y.

ALCO

ALCO PRODUCTS, INC.

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Locomotives · Diesel Engines · Nuclear Reactors · Heat Exchangers · Springs · Steel Pipe · Forgings · Weldments · Oil-Field Equipment

No "Shade Tree" Jobs at

WAUKESHA

SALES AND SERVICE, INC.

One of the 13 modern Waukesha Sales & Service, Inc., Sales and Service Stores.

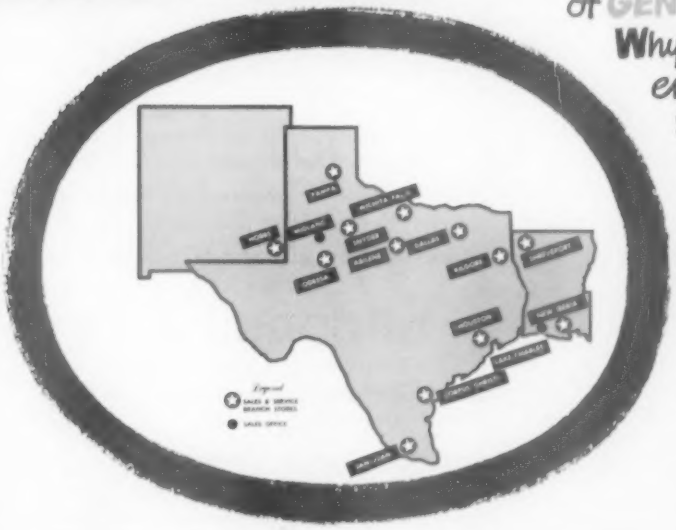
Complete repair facilities in a typical Sales and Service Shop.

Only at Waukesha Sales & Service, Inc., are you assured of getting genuine Waukesha parts.

Complete stocks of parts at all Sales and Service Stores.

At Waukesha Sales & Service, Inc. you get a professional repair job. Every one of Waukesha's thirteen branches gives you fast efficient service with modern equipment, factory trained mechanics and complete stocks of GENUINE Waukesha parts.

Why take a chance? Send your engine home to Waukesha Sales & Service, Inc. and get the job done right.



WAUKESHA

Sales & Service, Inc.

1422 MAURY ST. • HOUSTON, TEXAS

EXCLUSIVE DISTRIBUTORS FOR WAUKESHA PRODUCTS IN TEXAS, NORTH AND WESTERN LOUISIANA, SOUTHERN ARKANSAS AND NEW MEXICO

WORLD'S LARGEST DISTRIBUTOR OF OIL FIELD ENGINES

Wagner TRANSFORMERS...THE CHOICE OF LEADERS IN INDUSTRY

Where uninterrupted power is a must...

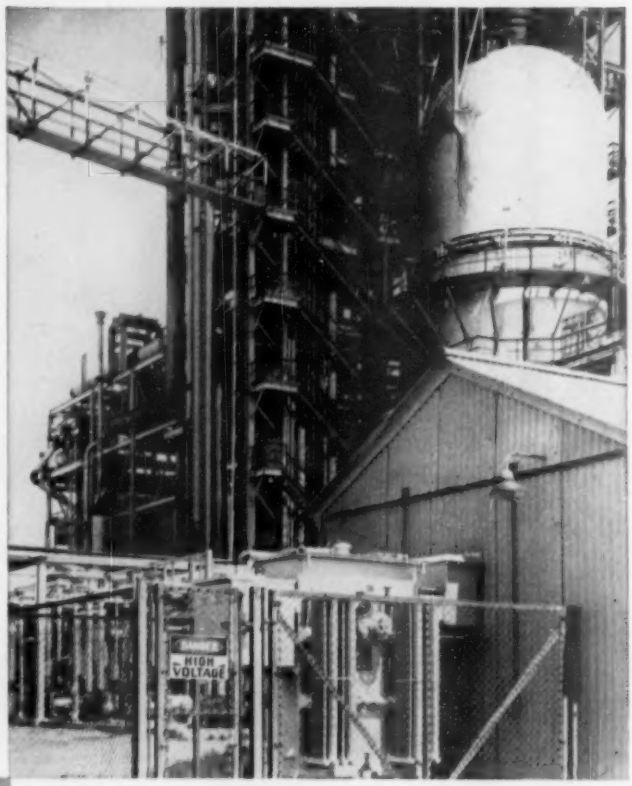
WAGNER UNIT SUBSTATION TRANSFORMERS

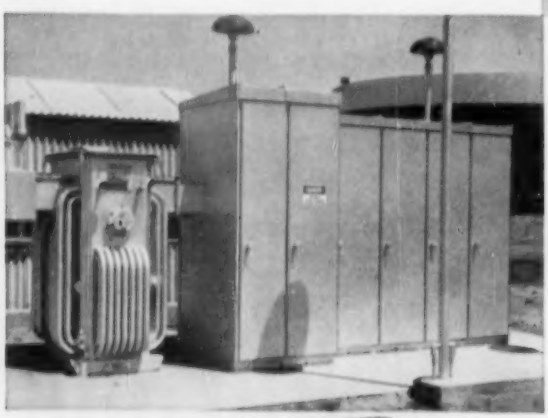
A completely dependable power supply is a vital necessity to an oil refinery. A power interruption of only a few minutes on a "cat cracker," like the one shown at the right, would completely disrupt this important processing operation and cause a shut-down of the entire refinery.

That's why you'll find Wagner Unit Substation Transformers at work at the Carter Oil Company refinery at Billings, Montana.

Wagner transformers are often found in installations where power supply failure would incur great loss because they have a reputation for complete dependability—backed by sixty-five years of transformer building experience.

Wagner Unit Substation Transformers, both liquid-filled and dry-type, are carefully designed to meet distribution requirements. Both liquid-filled and dry-type unit substation transformers are built in ratings through 2000 kva, 15 kv and below—you can choose the type and rating that exactly meets your load-center distribution requirements. Call the nearest of our 32 branch offices, or write us.





The 750 kva, 2400/4160Y to 480 volt, 60 cycle, three-phase, liquid-filled Wagner Unit Substation Transformer feeds the catalytic unit at The Carter Oil Company refinery. At left is shown a 225 kva Wagner substation transformer connected to an outdoor substation at the same refinery. Purchased and installed by The Fluor Corporation, Ltd., Engineers and Constructors for the Petroleum, Chemical and Power Industries, Los Angeles.

* * *

Write for Bulletins TU-205 and TU-214. They give full information on Wagner Unit Substation Transformers. Consult the nearest of our 32 branch offices about your next transformer installation.

Wagner Electric Corporation EST. 1891

Wagner Electric Corporation
6389 Plymouth Ave., St. Louis 14, Mo., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

W156-9

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

Get More Hole For Your Wire Rope Dollar with J&L SpringKore Rotary Drilling Lines

SpringKore's tightly coiled, high quality steel spring center was developed by J&L to give rotary drillers a wire rope with unusually high resistance to crushing action *plus* extreme flexibility.

Check these features of J&L SpringKore Rotary Drilling Lines and see why you get longer service life on your rotary rigs at lower drilling line costs.

LONG-TERM FLEXIBILITY

SpringKore's highly flexible center and wide distribution of internal pressures maintains original rope flexibility under long periods of heavy duty service.

RESISTS CRUSHING ACTION

Coiled steel spring center has great resistance to crushing . . . snaps rope back to its original shape and diameter.

COMPLETE LUBRICATION

SpringKore's hollow center acts as a lubricant reservoir . . . reduces corrosion and friction wear by assuring lubrication of innermost parts of rope.

MORE SUPPORTING CONTACT POINTS

The coiled shape of the spring center gives the strands of the rope more supporting points . . . reduces friction by spreading pressure evenly over many contact points.

UNIFORM DIAMETER

The firm internal support provided by the spring center maintains uniform rope diameter . . . reduces wear caused by outer strands rubbing against each other.

LESS INSIDE STRAND WEAR

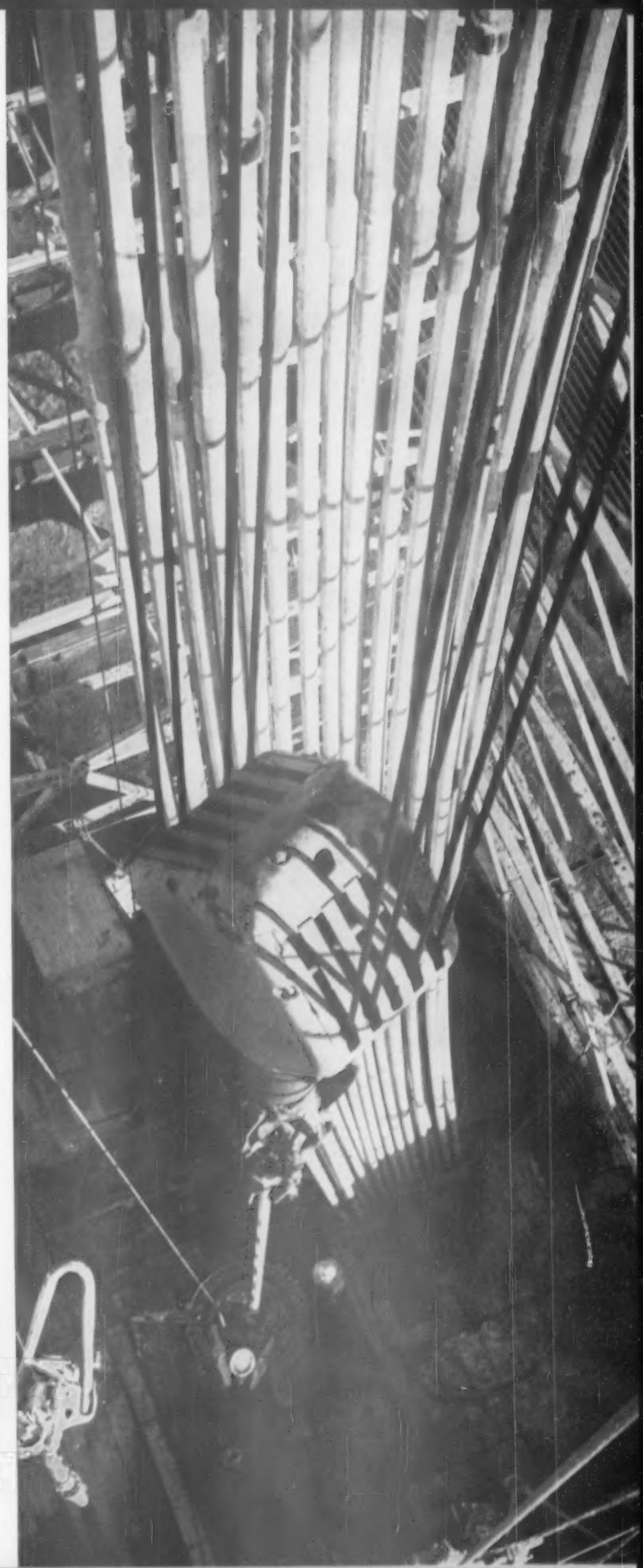
The spring center flexes under crushing instead of scoring strands . . . reduces wear on inside wires.

Put these SpringKore advantages to work on your rotary drilling rigs. Specify J&L SpringKore Rotary Drilling Lines. Available in standard sizes and construction.

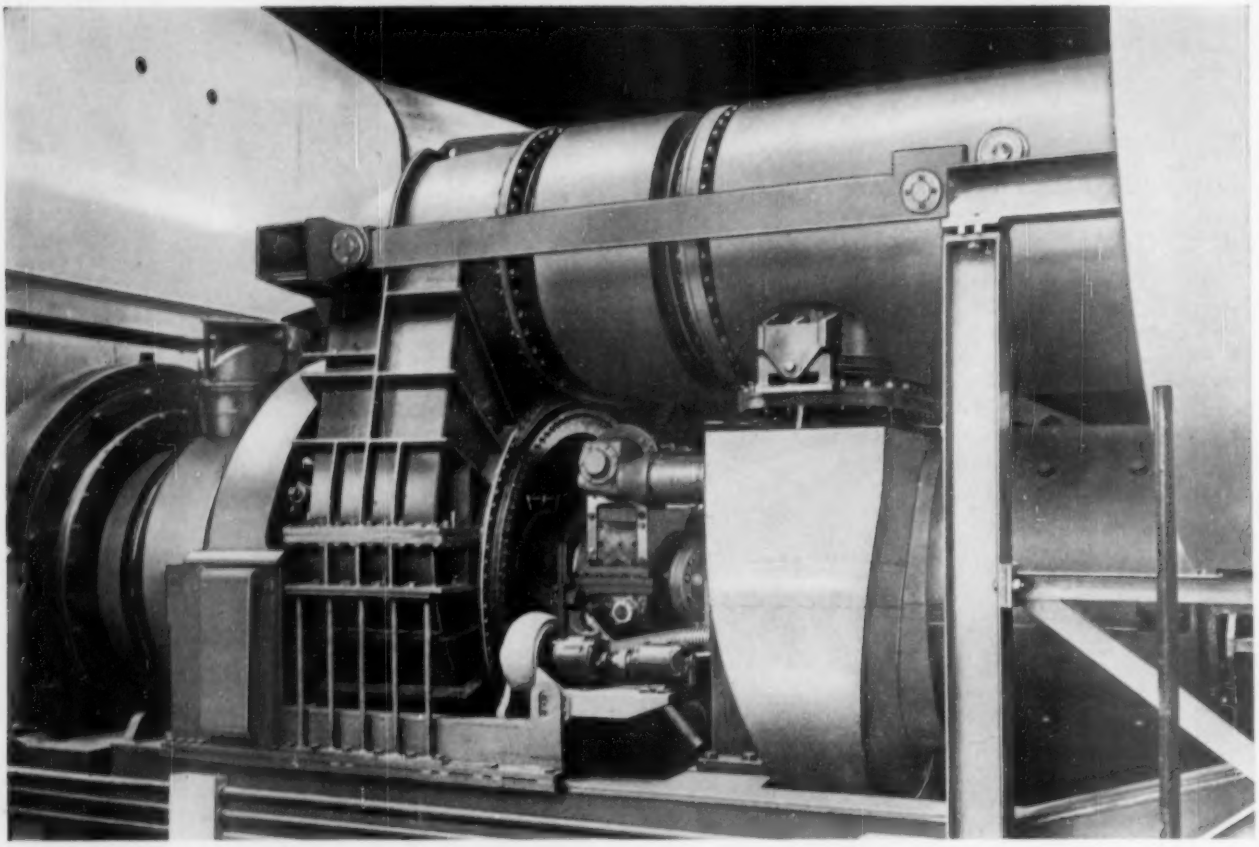
Jones & Laughlin

STEEL CORPORATION · PITTSBURGH

J&L STEEL

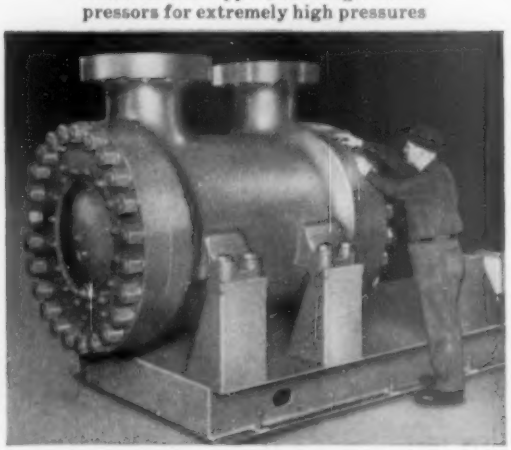


GAS TURBINES



Clark 8500 BHP Gas Turbine for centrifugal compressor, generator or pump drive

Clark Barrel Type Centrifugal Compressors for extremely high pressures



CLARK®

GAS TURBINES
CENTRIFUGAL COMPRESSORS

CENTRIFUGAL COMPRESSORS
Only CLARK builds both!

Now you can get centrifugal compressors and modern gas turbines to drive them *exclusively* from one manufacturer . . . Clark.

In addition to saving money and headaches, you'll get proved, matched-performance "packages" specifically designed for continuous trouble-free service.

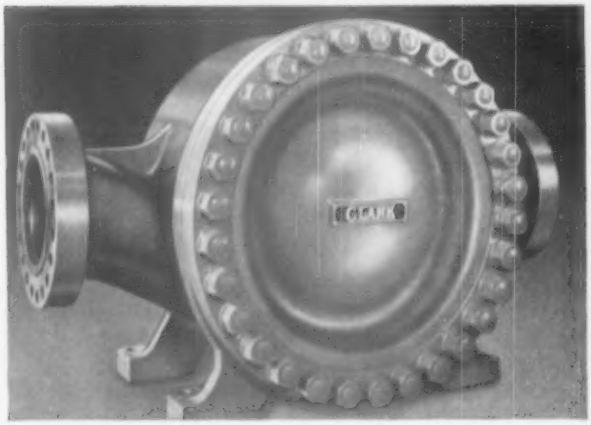
Whether you have a million or a billion cubic feet of air or gas per day to handle at pressures of up to 4500 pounds per square inch, there is a Clark centrifugal compressor and in most cases a matching Clark gas turbine to drive it.

Your nearest Clark representative will be pleased to give you all the facts.

CLARK BROS. CO., OLEAN, N. Y.
One of the Dresser Industries
Offices in Principal Cities throughout the World

Clark Multi-Stage Centrifugal Compressors for process application

Clark Centrifugal Pipeline Booster for low ratios and high pressures



They Will Stand Close Inspection

The young man at the hobbing machine is merely giving his work an appraising look. Detailed inspection will come later, and it is safe to say that the verdict will be favorable. For this is the shop of The Adams Company, Dubuque, Ia., specialists in the art of making good gears.

Each of the gears in the photograph has 86 teeth; is 22 in. in diameter and weighs 153 lb finish-machined. Each is intended for use in heavy-duty excavating equipment. Four gears are machined at one time in the hobber, though you may have to look sharply to detect all four.

The gears are made from Bethlehem circular blanks. These blanks are both forged and rolled by a unique single-step method that insures great strength, uniform density, and regular grain flow. Blanks made by this process can be furnished in a wide variety of sections, and in sizes ranging from 10 to 42 in. OD.

Excellent for heavy-duty gears, Bethlehem blanks also have many other end uses—sheave wheels, crane wheels, flywheels, turbine rotors, pipe flanges, etc. Whether you manufacture gears or something else requiring circular blanks, we'd like the chance to send you full details. A letter, wire, or telephone call will bring the complete story to you promptly.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Clear proof you can prevent plugging caused by iron in injection water!
CITRIC ACID ADDED
In this glass, only 10 ppm of Pfizer Citric Acid has been added to brine containing 2 ppm iron.
NO CITRIC ACID
The brine in this glass also contains 2 ppm iron. But no citric has been added

● The cloudiness of the brine at right is caused by insoluble iron salts. Continuous injection of this water in secondary recovery causes plugging at the interface.

As you can see from the picture on the left above, Pfizer Citric Acid keeps the iron in your injection water from precipitating out...and thus piling up deposits at the interface.

Net result: Regular use of Pfizer Citric Acid will keep your injection rates high easily and economically. Also cuts down the frequency of expensive acidizing.

Pound for pound, citric acid sequesters iron better and at less cost than any other agent. High calcium and magnesium waters will not interfere with citric's iron-sequestering ability.

Nontoxic, safe to handle—Pfizer Citric Acid is excellent preventive medicine—whether for secondary recovery or pressure maintenance work. Pfizer supplies huge amounts of citric acid for a multitude of industrial uses throughout the world. This broad distribution pattern assures you of receiving all the citric you need without delay. (Just recently, Pfizer has opened a new warehouse in Dallas to serve the Southwest.)

For further information on preventing injection well plugging with Pfizer Citric Acid write to:

Manufacturing Chemists for Over 100 Years

Pfizer

CHAS. PFIZER & CO., INC.
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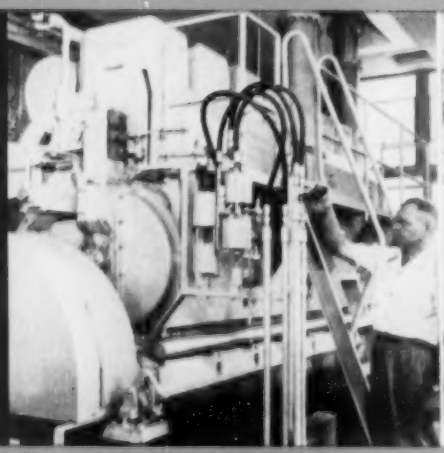
Branch Offices: Chicago, Ill.; San Francisco, Calif.; Vernon, Calif.; Atlanta, Ga.; Dallas, Texas

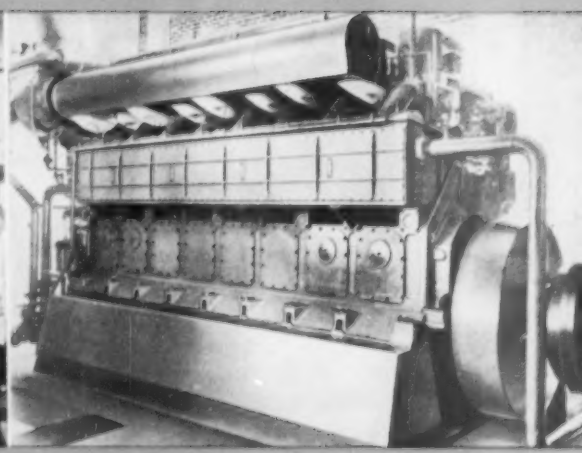
NORDBERG ENGINES

Provide Low Pipe Line Transportation Costs ACROSS the Continent

• Each year there are more and more Nordberg engines installed by pipe lines. The reasons are sound . . . these compact, more powerful engines efficiently meet the operator's requirements for all types of pumping.

NORDBERG POWER ON THE JOB:



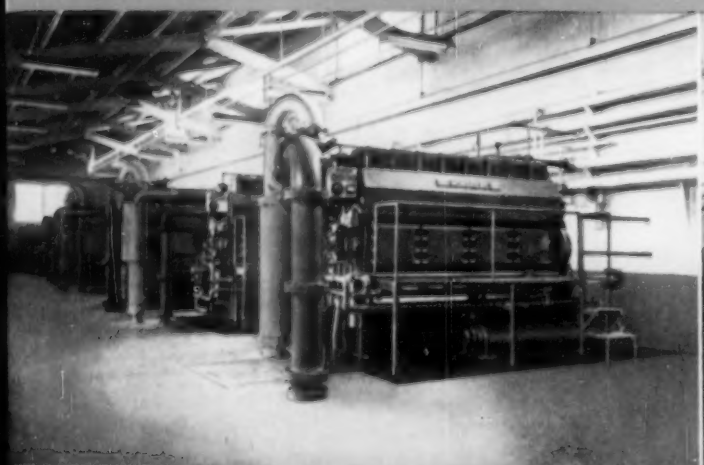


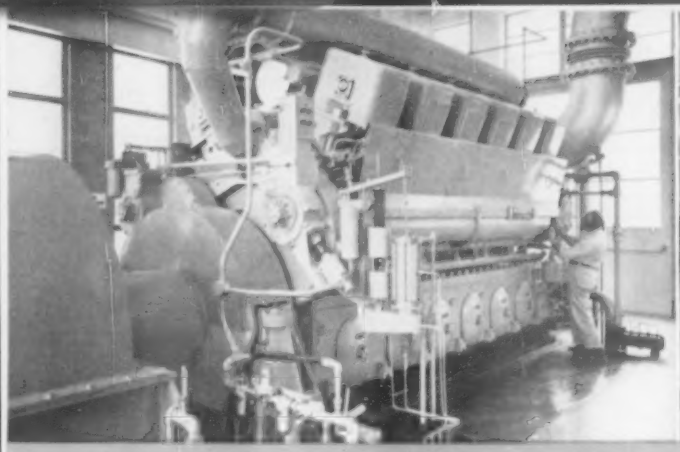
• One of two Nordberg eight cylinder, 1210 hp Supercharged Diesels on Shell Oil Company's Weed River products pipe line.

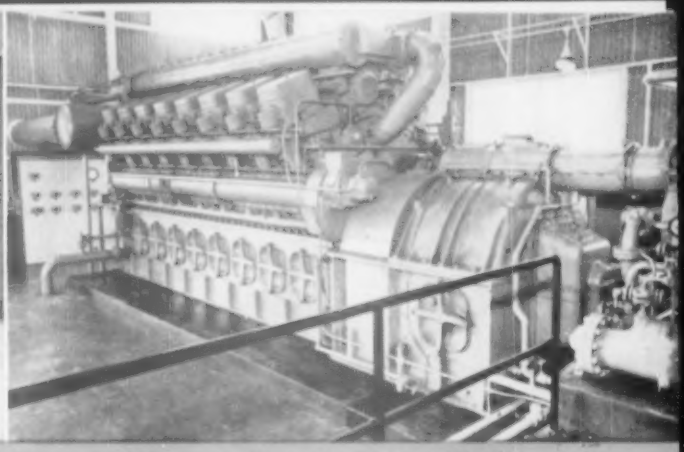
• Four of the 23 Nordberg engines installed in stations along the Rangeley, Colo.-Salt Lake City crude and products lines operated by Salt Lake Pipe Line Company.

• One of nine Nordberg eight cylinder, 13" bore SUPAIR-THERMAL® Dualfuel engines operating on a Phillips Pipe Line Company products line.

• Twelve of these Nordberg SUPAIRTHERMAL engines provide a total of 22,680 hp for pumping stations along the Lakehead Pipe Line Company's line.





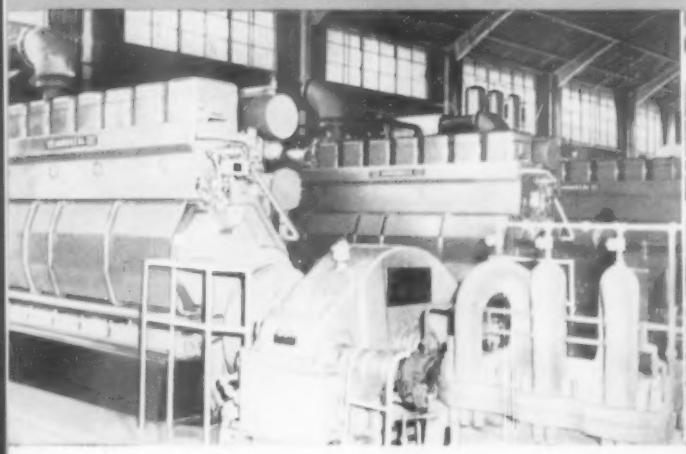


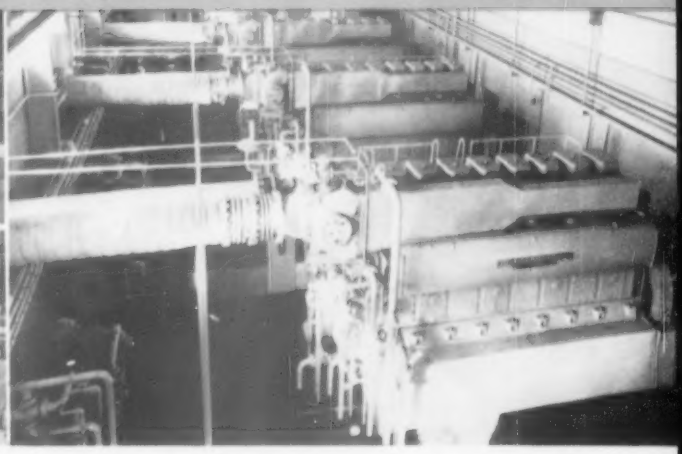
• Nordberg 2650 hp automatically-controlled SUPAIR-THERMAL V-type Diesel furnishes all power for the Vicksburg, Mich., station on the Wolverine Pipe Line Company's products line.

• Three of six Nordberg 1050 hp Duafuel engines installed in the Tejon and Wheeler Ridge stations of Richfield Oil Corporation's crude oil pipe line.

• 3000 hp Nordberg V-type SUPAIRTHERMAL Spark-Ignition Engine Gear Set driving a centrifugal gas compressor in Transcontinental Gas Pipe Line Corporation's Station 23 near Houston, Texas.

• Three of 12 Nordberg SUPAIRTHERMAL engines, totalling, over 20,000 hp, installed along the Trans Mountain Pipe Line from Edmonton, Alta., to Vancouver, B.C.





SUPAIRTHERMAL® ENGINES

the logical choice for these basic power jobs:

- PIPE LINE PUMPING
- GAS COMPRESSOR DRIVE
- POWER GENERATION

Nordberg four-cycle Supairthermal engines are available in a full range of sizes from 535 to 5000 hp for Diesel, Duafuel® or Spark-Ignition Gas operation, including both In-line and "V" types. The Supairthermal principle increases the engine's load-carrying ability over a wide speed range. This reserve power is like "money in the bank" when additional capacity is needed. We welcome your inquiry and the opportunity to assist you with your power study.

NORDBERG MFG. CO., Milwaukee, Wis.

Builders of America's Largest Line of Heavy Duty Engines—10 to over 12,000 Horsepower

NORDBERG

DIESEL • DUAFUEL® AND SPARK-IGNITION GAS ENGINES

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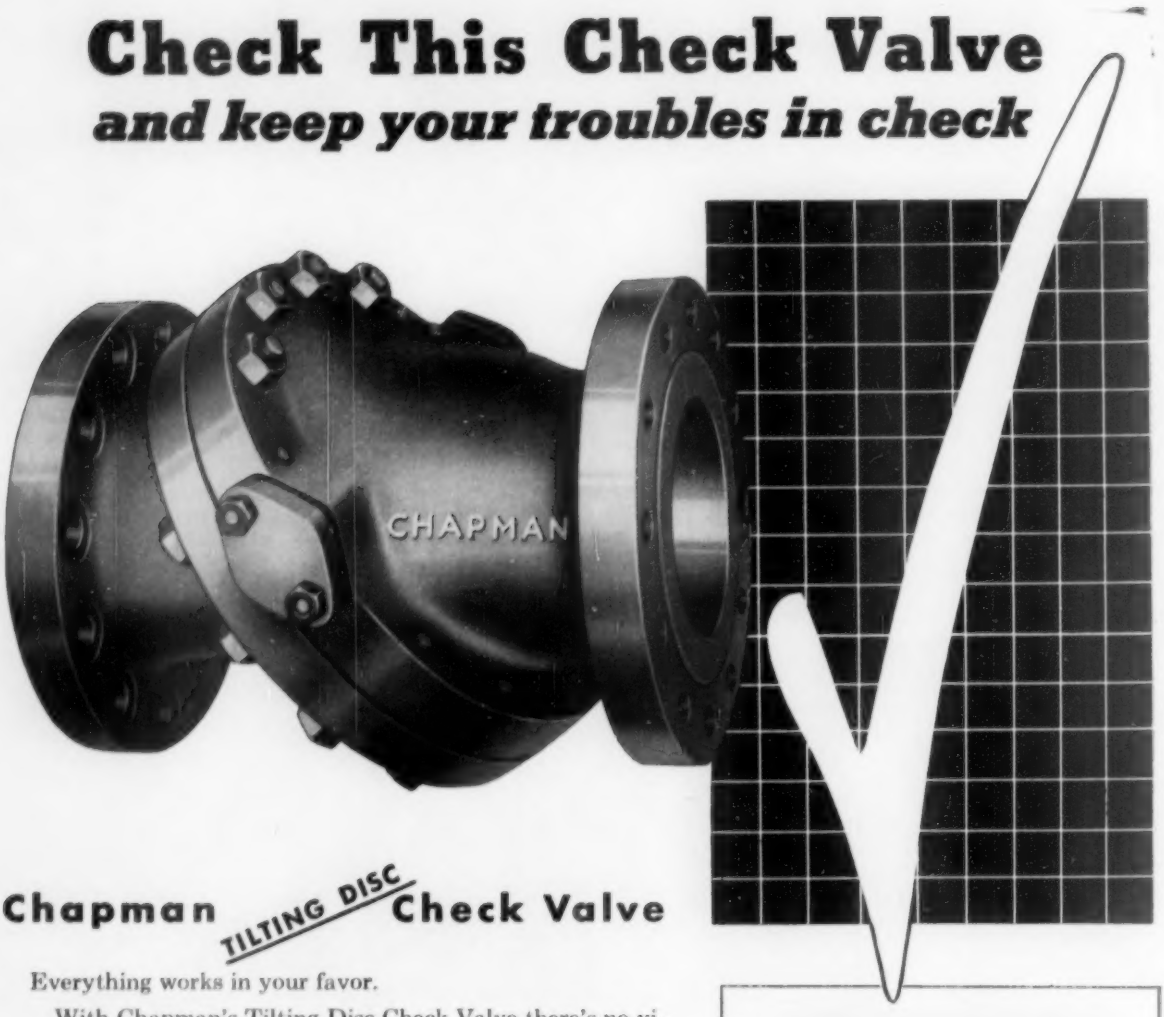
0256

Check This Check Valve
and keep your troubles in check



Chapman TILTING DISC Check Valve

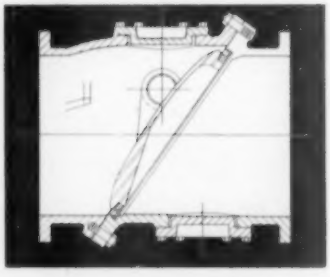
Everything works in your favor.

With Chapman's Tilting Disc Check Valve there's no vibration, no fluttering, no noise. There's no slamming, with usual piping arrangements, no banging to cause damage to system or valve. There's no grinding, scraping or wearing to either the disc or seat.

All of this means less headaches to you . . . both physical and financial headaches. The smooth, sure, quiet action means less, much less, maintenance over the longest period under toughest operating conditions.

Chapman Tilting Disc Check Valves with money-saving advantages like these are available in iron and steel, with standard end to end, for handling fluids or gases under a wide range of pressures. They're listed and shown in our Catalog 30-A. Send for it and check the valves you need for replacement or new piping systems, right now.

The CHAPMAN Valve Mfg. Co.
INDIAN ORCHARD, MASSACHUSETTS



The Valve That Goes with the Flow

Here's the idea in back of it all. When the flow is on, "airfoil" disc is held firmly against stops in the body. When the flow drops, disc balances itself quietly on whatever flow there is. When the flow stops, disc drops quickly and tightly on special bevel seat. It's as simple as that. It's as sound as that. And valve men will be pleased when they see that enough room is given around disc to cut down flow resistance.

No problems here !

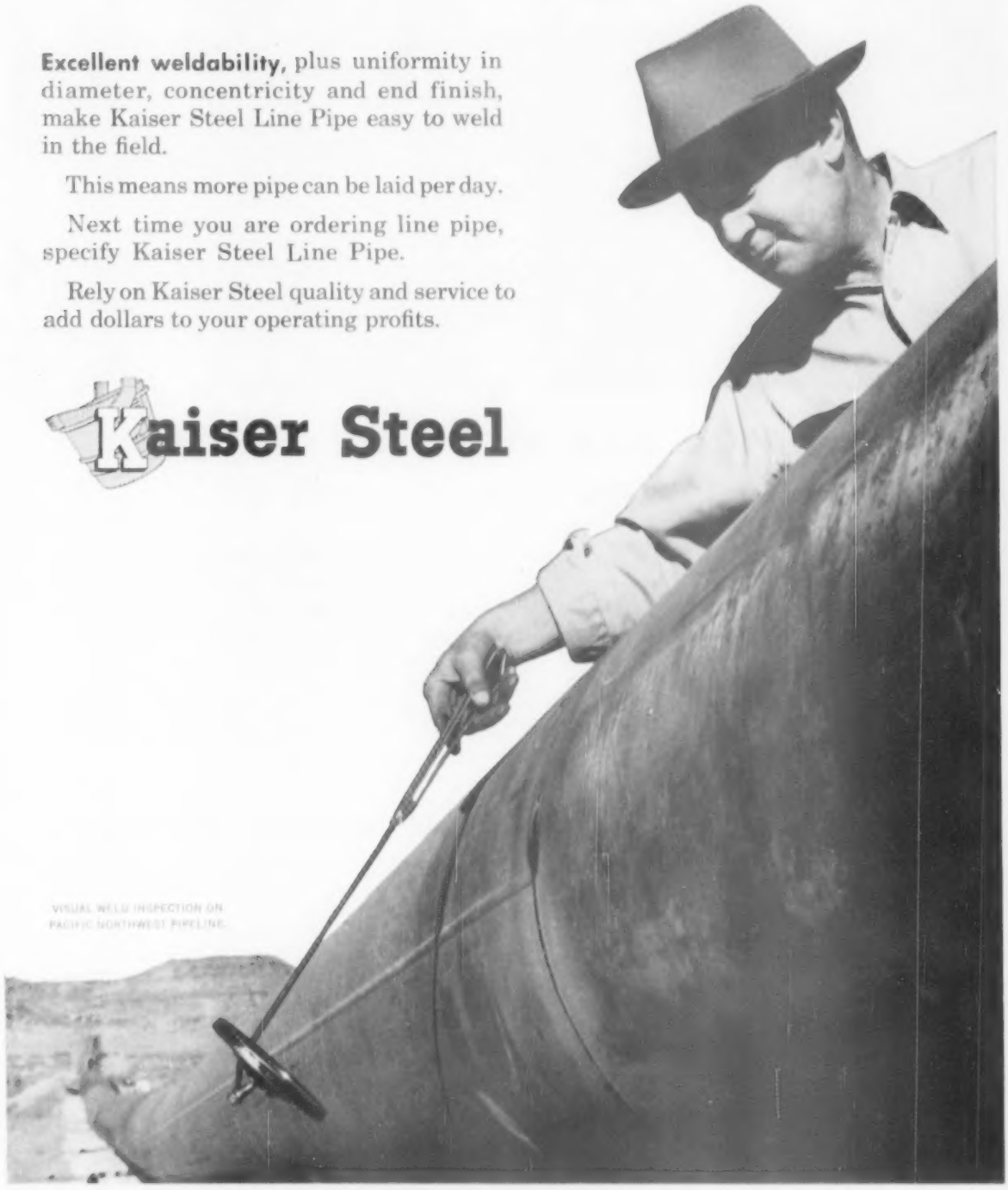
Excellent weldability, plus uniformity in diameter, concentricity and end finish, make Kaiser Steel Line Pipe easy to weld in the field.

This means more pipe can be laid per day.

Next time you are ordering line pipe, specify Kaiser Steel Line Pipe.

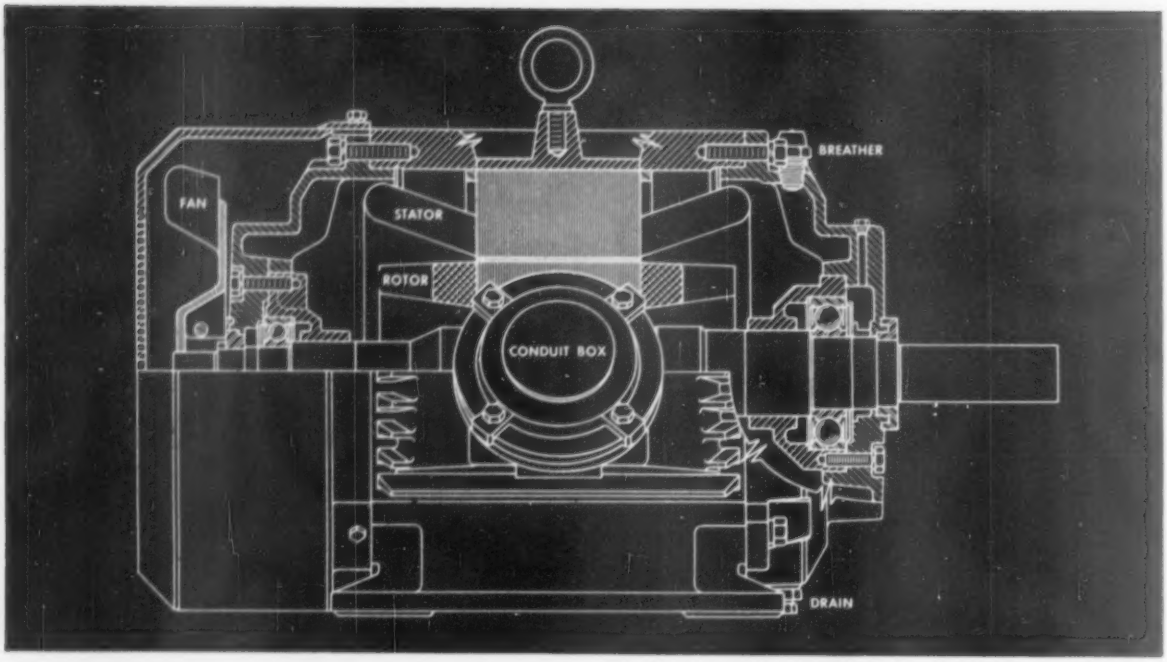
Rely on Kaiser Steel quality and service to add dollars to your operating profits.

Kaiser Steel



VISUAL WELD INSPECTION ON PACIFIC NORTHWEST PIPELINE.

Steel Mill Products: pipes • hot rolled strip and sheet • cold rolled strip and sheet • tin plate • continuous weld pipe • electric weld pipe • alloy and carbon bars • hot shapes • structural shapes semi-finished steels • pig iron • ingot molds • coke by-products • **Fabricating Division:** steel fabrication for construction, aircraft, missile and other industries • expanded fusion weld pipe reinforced concrete pipe • tanks • For specifications, write: **KAISER STEEL CORPORATION** • **Los Angeles** • **Oakland** • **Seattle** • **Portland** • **Phoenix** • **Denver** • **Tulsa** • **New York**



THIS MOTOR CAN CUT YOUR HAZARDOUS ATMOSPHERE INSURANCE COST

Insuring facilities with electric motors in hazardous atmospheres is generally expensive or impossible without special motors. Reliance has developed a completely new, Underwriters' approved motor design, called explosion-proof, for hazardous locations. In fact this is the only motor design that meets all qualifications for class I, group D and class II, groups E, F and G without requiring modification.

This new motor incorporates all of the outstanding features of the standard Reliance Totally-Protected Motor. In addition, all Reliance Explosion-Proof Motors are built to corrosion-proof standards.

If you would like to have more information on what qualifies a motor for hazardous atmospheres, write for our new Explosion-Proof Motor Bulletin No. B-2409. B-1626

NATIONAL ELECTRICAL CODE CLASSES OF HAZARDOUS LOCATIONS

CLASS I—Those in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.

Group D—Atmospheres containing gasoline, hexane, naphtha, benzine, butane, propane, alcohols, acetone, benzol, lacquer solvent vapors, or natural gas.

CLASS II—Those which are hazardous because of the presence of combustible dust.

Group E—Atmospheres containing dust of aluminum, magnesium, or their commercial alloys.

Group F—Atmospheres containing carbon black, coal or coke dust.

Group G—Atmospheres containing flour, starch or grain dust.

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RELIANCE ELECTRIC AND ENGINEERING CO.

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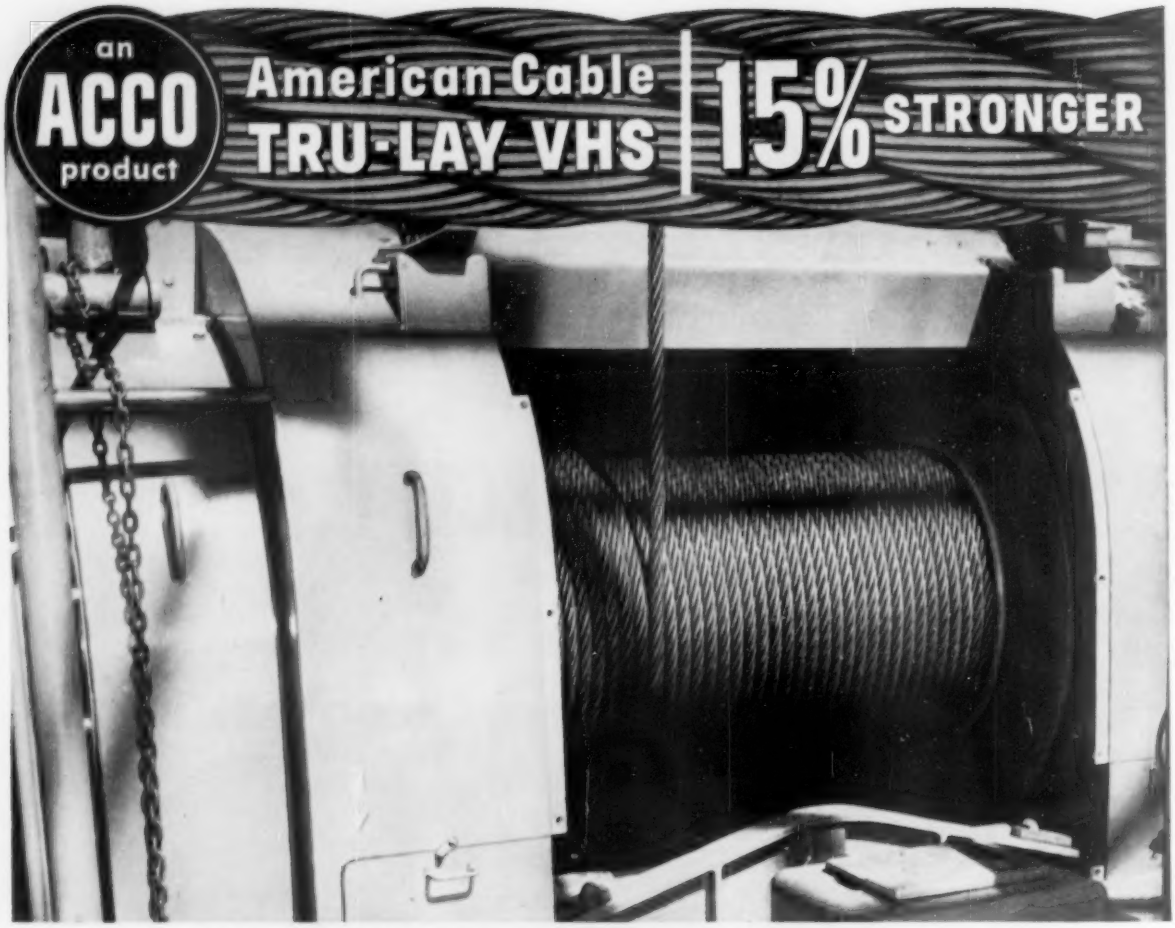

New VHS Rotary Drilling Lines Give Higher Factor of Safety

Made of a new grade of steel for wire rope, new VHS drilling lines are 15% stronger than lines made of Improved Plow Steel—the best grade available before the introduction of VHS. This means that 10 lines of VHS have a factor of safety 14.9 or 15% higher than 10 lines of IPS. Or, to say it another way, the factor of safety for 10 lines of VHS is just about equal to the factor of safety for 12 lines of the same diameter in IPS.

Drill Faster, Cut "Down Time"

The additional strength of new VHS gives you many other advantages. For example you can drill deeper before increasing the number of parts of line—and make round trips faster. And VHS's greater strength often eliminates any necessity for buying new blocks or regrooving sheaves to use larger diameter lines for higher safety factor.

Resists Abrasion, Peening

In addition to its greater strength, VHS is also tougher. Because it is stronger *and* tougher it has greater resistance to abrasion, and higher resistance to peening . . . both are important factors in maintaining diameter and shape. Ton mile advantages should result if regular adaptable cut-off practices are followed.

Ordering Is Easy

Nothing could be simpler than ordering VHS Rotary Drilling Lines. Just ask your nearest Mid-Continent Supply store for a VHS drilling line in the length and diameter you need. For further information write to the nearest American Chain & Cable Company office listed below for **Brochure DH-516H**

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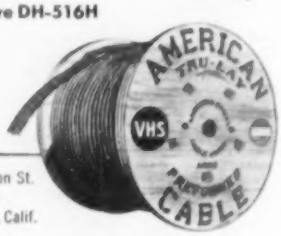
AMERICAN CHAIN & CABLE

630 McFarland St. | Houston 1, Texas
4555 E. 46th Ave. | Denver 16, Colorado
2216 S. Garfield Ave. | Los Angeles 22, Calif.
400 W. Madison St. | Chicago 6, Ill.
Wilkes-Barre, Pa.; Odessa, Texas; New York, N.Y.; Philadelphia, Pa.; San Francisco, Calif.



are man-hours slipping through your fingers?

P-A-X Business Telephone Systems cut this loss

These are some of the oil companies saving man-hours with one or more P-A-X Business Telephone Systems!

Atlantic Refining Company, since 1923, 1,642 telephones.
Cities Service Oil Company, since 1914, 222 telephones.
Humble Oil and Refining Company, since 1929, 1,525 telephones.
Phillips Petroleum Company, since 1939, 447 telephones.
Shell Oil Company, since 1919, 2,400 telephones.
Union Oil Company of California, since 1941, 1,555 telephones.

When your people have to walk about to exchange information, they're wasting time—through no fault of their own! What you need is a P-A-X Business Telephone System, providing "touch-of-a-dial" communication to the office next door—or 'way in the next division!

Through the P-A-X System, each person can reach anyone else—in seconds. Overall supervision is made easier, and all departments can coordinate their activities for top efficiency. That's why many oil companies depend on P-A-X for lightning-fast communication throughout the length and breadth of their widespread operations.

Rent-free P-A-X is company-owned and controlled; your own communications men install and move P-A-X telephones as you wish. It is rent-free, entirely separate from the public telephone system, and uses company-owned or leased lines.

Discover how other oil companies are saving time and money, increasing efficiency, with a P-A-X Business Telephone System. For an actual "on-the-job" case study, *write:* Automatic Electric Sales Corporation (HAymarket 1-4300), 1033 West Van Buren Street, Chicago 7, Illinois. *In Canada:* Automatic Electric Sales (Canada) Ltd., Toronto. *Offices in principal cities.*

Howard L. Housley	M. G. Gnau	L. C. Wiley
Tel.: Prospect 1470	Tel.: JEfferson 1-2520	Tel.: 2-9032
Dallas, Texas	St. Louis, Mo.	Brownwood, Texas

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Originators of the dial telephone • Pioneers in automatic control

GENERAL TELEPHONE SYSTEM

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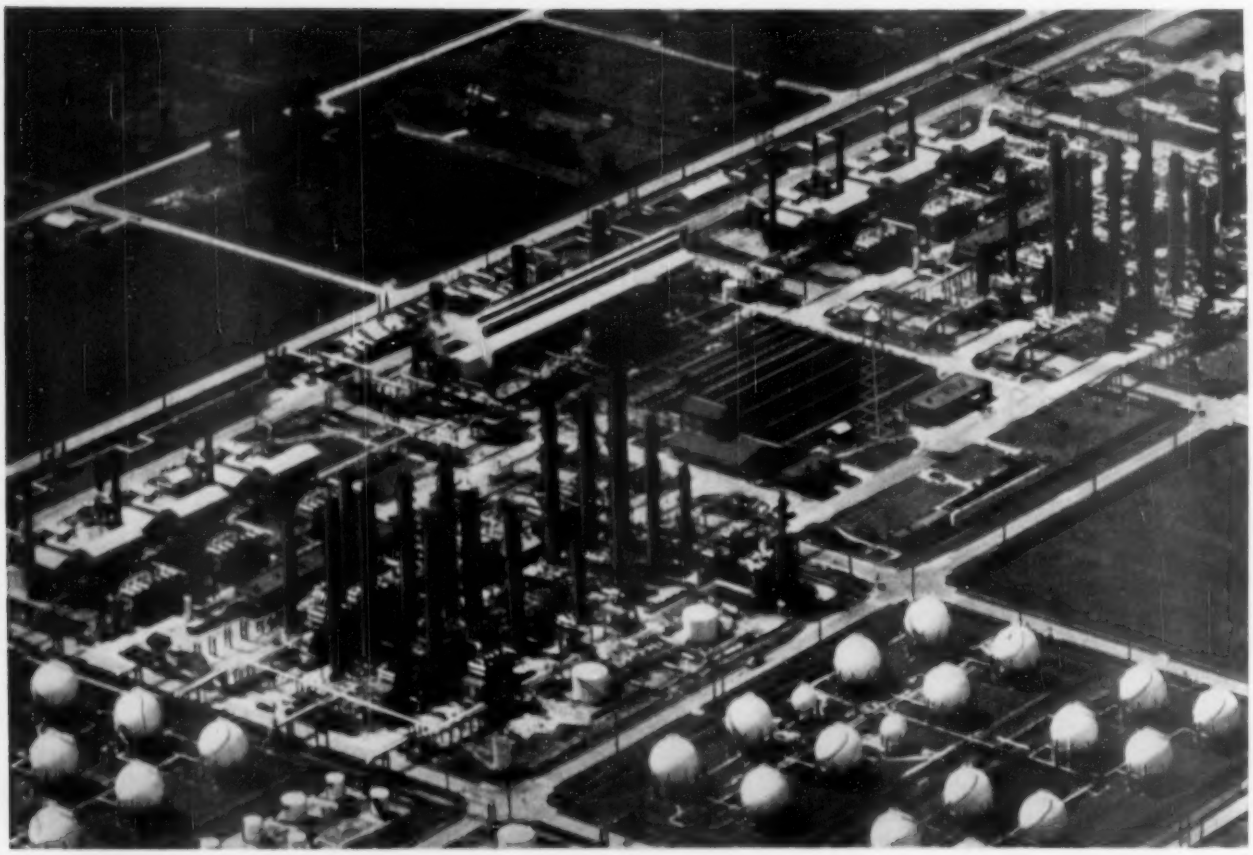
Port Neches expansion,



Present facilities of the world's largest Butadiene plant – the Port Neches plant of Neches Butane Products Company – will be augmented by Foster Wheeler to effect a 50% increase in total capacity.

FOSTER

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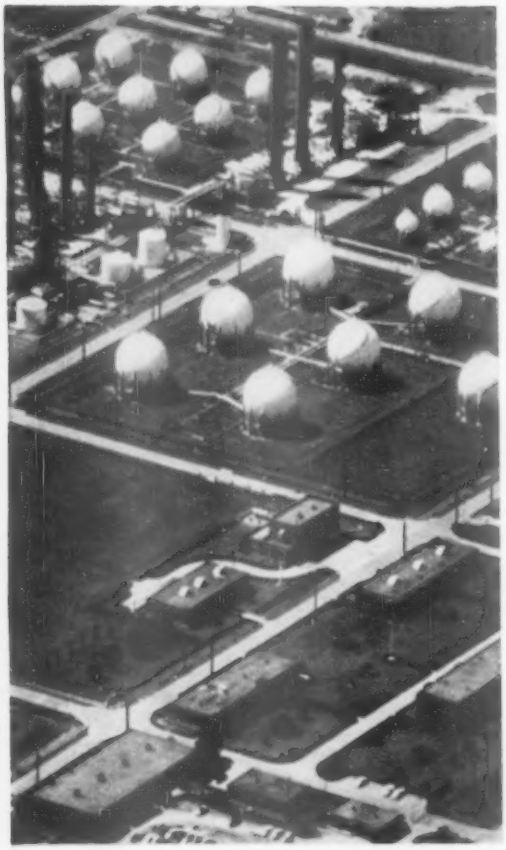
diene

200,000 to 300,000 tons/year

by Foster Wheeler



FOSTER WHEELER CORPORATION will provide process and mechanical design, engineering and construction for the expansion program at the Port Neches Butadiene plant of the Neches Butane Products Company. The plant, recently purchased from the government, is jointly owned by the Texas-U.S. Chemical Company and Goodrich-Gulf Chemicals Inc.

The present capacity of this plant, the largest in the world for the production of Butadiene, will be increased from 200,000 tons/year to 300,000 tons/year.

In addition to new process units, new steam generation, cooling water utilities and inter-plant facilities will also be provided by Foster Wheeler.

With engineering offices in New York, London, Paris and St. Catharines, Ontario, and complete fabrication facilities at Mountaintop, Pa., Dansville, N. Y., Carteret, N. J., St. Catharines, Ontario and Egham, Surrey, England, Foster Wheeler offers a world-wide service in the design, engineering, fabrication and construction of petroleum, petrochemical or chemical process plants or processing units.

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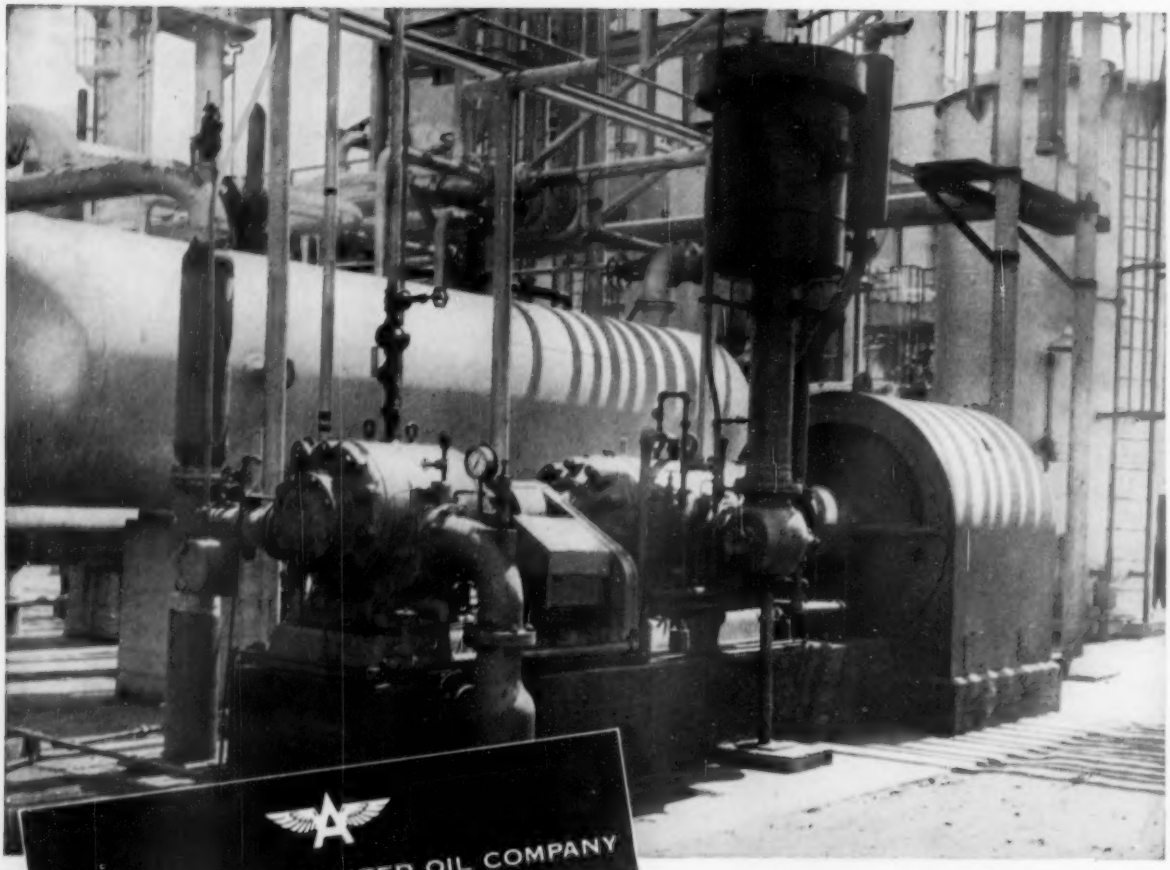

installs fuller rotary compressors in its Avon Refinery

When Tide Water Associated needed additional air for various operations in its Avon plant, its engineers investigated the possibilities of the Fuller Rotary Compressor. After making a thorough study of its merits, Tide Water purchased and installed two C-300-300H two-stage units, each supplying 1598 c.f.m., 100-lb. air for general plant use, one of which is shown above. Note that this machine is installed out in the open with no protection from varying weather conditions, operating 24 hours per day, seven days a week.

These two-stage machines are located in different departments of the plant to best meet the air-load requirements of the particular department being served.

Tide Water also has installed in this same plant, two C-300 Fuller Rotary single-stage compressors with a capacity of 1542 c.f.m. each, at 40-lb. pressure, used in the catalyst-cracking process.

Hundreds of Fuller Rotaries are serving the petroleum industry, proving their worth for general plant air, purging gas, refrigeration in alkalization units, and handling butane-butylene in the refinery, as well as in the field for pressure boosting and gas gathering.

Simplicity of construction has proved to be one of the important factors—no valves to leak, no seats to grind, results in maintained capacity for the life of the machine; simplified drive eliminates power transmission losses. For full information write us for Bulletin C-5A.

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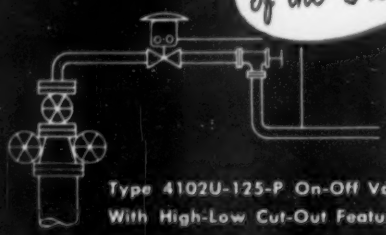
Hi-Low Cutout Controllers

The Sentinel of the Field

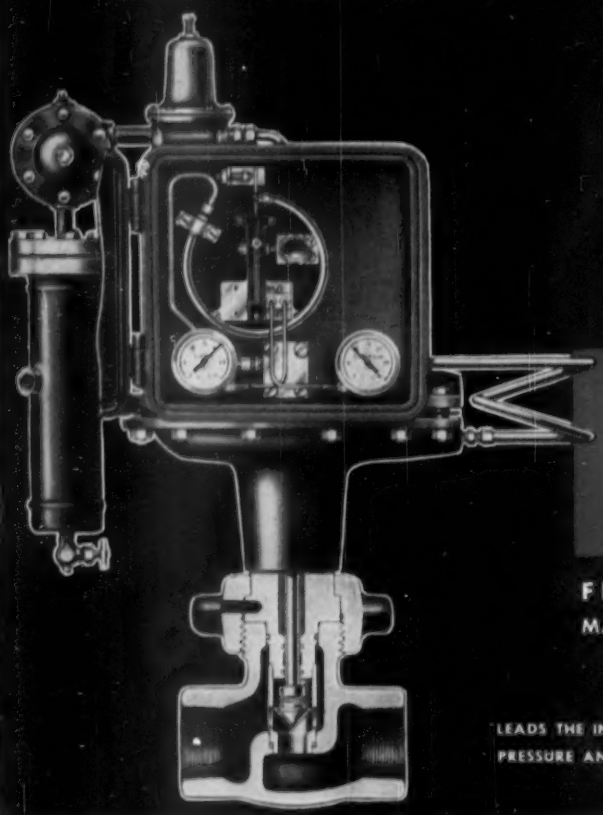
Type 4102UR-125-P Field Valve With Low Pressure Cut-out Feature

Always on guard, the Fisher Type 4102UR pilot when installed in gathering lines will throttle or reduce the pressure to separators and will automatically close if a break in the line occurs, thus protecting the system from costly loss.



Type 4102U-125-P On-Off Valve With High-Low Cut-Out Feature

Ideal as a high-low pressure well head safety valve. Will stay open, but will automatically close if pressure goes above pressure limitations of downstream piping. Will also close if pressures fall too low *due to* a break in downstream system.



- **Wizard available with bronze or steel Bourdon tubes up to 5000 psi.**
- **Rugged and compact—entire controller not over 2 feet high.**
- **Series 125–P field valve supplied with heavy cast steel body good for 2000 psi.**
- **Topwork action reversible in field with no additional parts.**

SPECIFICATIONS

Body—Cast Steel—2000 psi WOG.
Sizes—1" and 2" screwed angle or globe.

Orifice Size—1" Body—⅛", 3/16", ¼", ⅜". 2" Body—¼", ⅜", ½", ¾", 1".

Valve Cage—440 hardened St. Steel. (Tungsten carbide insert also available.)

Inner Valve—440 hardened St. Steel. (Tungsten carbide tip also available.)

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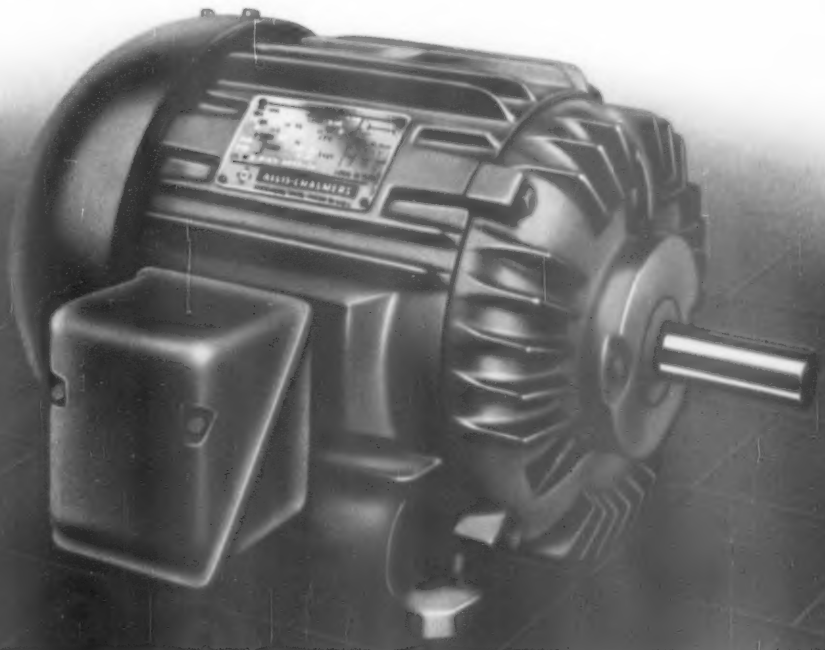

Why Rib-Type Motors Won't Fry

STRETCH OUT RIB DESIGN of Allis-Chalmers motors and see the greater cooling area provided — as much as 43% on many models. Insulation won't fry under normal conditions with deep-rib construction because every rib adds to the heat-dissipating surfaces. The result—moderate overloads can be taken in stride with little fear of burnouts.

As a new machinery component or as replacement, specify Allis-Chalmers. To find out more, contact your nearby A-C district office, distributor, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

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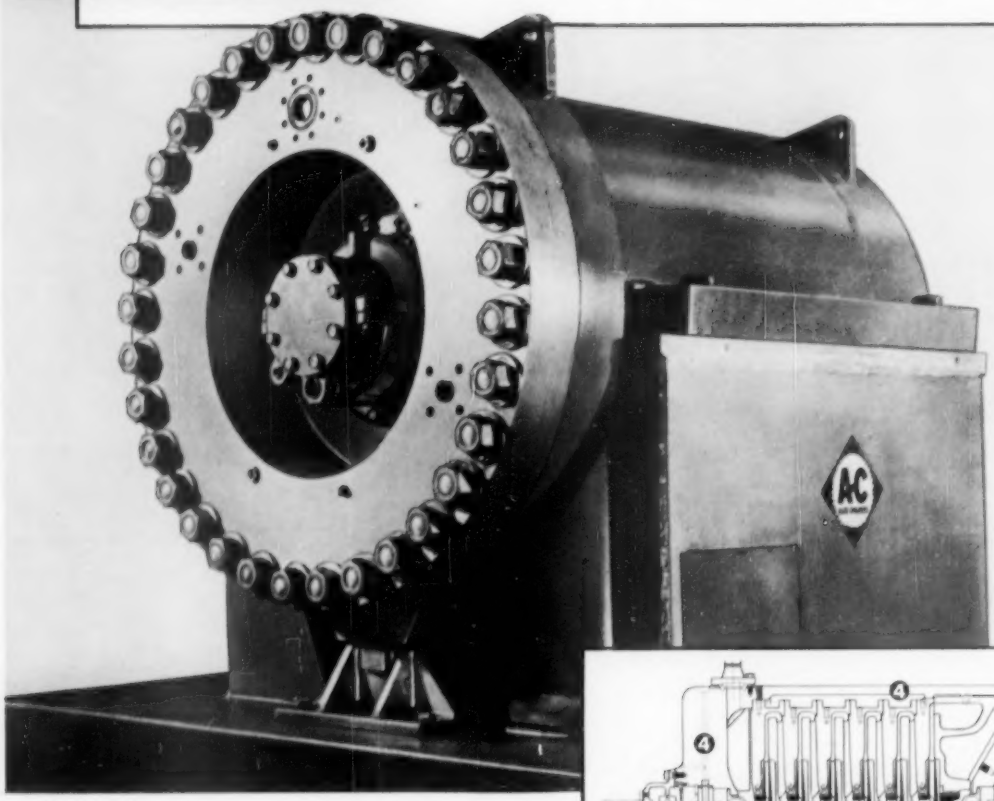
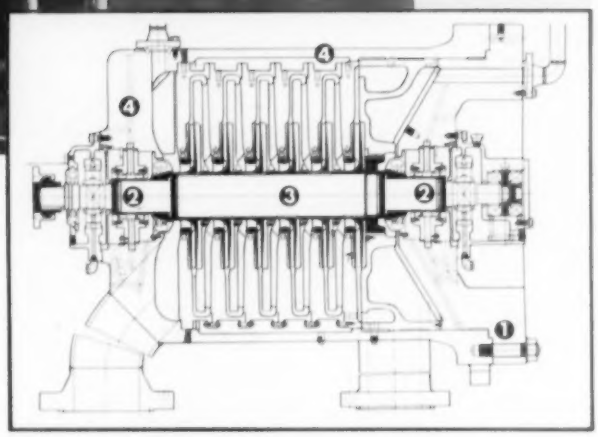
ALLIS-CHALMERS
High Pressure
Barrel-Type
COMPRESSORS

for Non-Stop Service





'Round-the-Calendar Operation is built into the complete line of Allis-Chalmers high pressure barrel-type units for reforming processes. Here are four reasons for their dependability:

1. Simple to Maintain — Only one head bolted. Spiral-wound metallic gasket provides positive seal of casing joint.

2. Shaft Sealing — Double bushing seals have separate high pressure oil system. Inward seal leakage minimized.

3. Rugged Rotor — Impellers shrunk and keyed to shaft. Riveted impellers have rivets milled integrally from blade edge.

4. Extra Strong — Vertically split forged steel casings give maximum safety at high pressures.

Find out more by contacting your nearby A-C office, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

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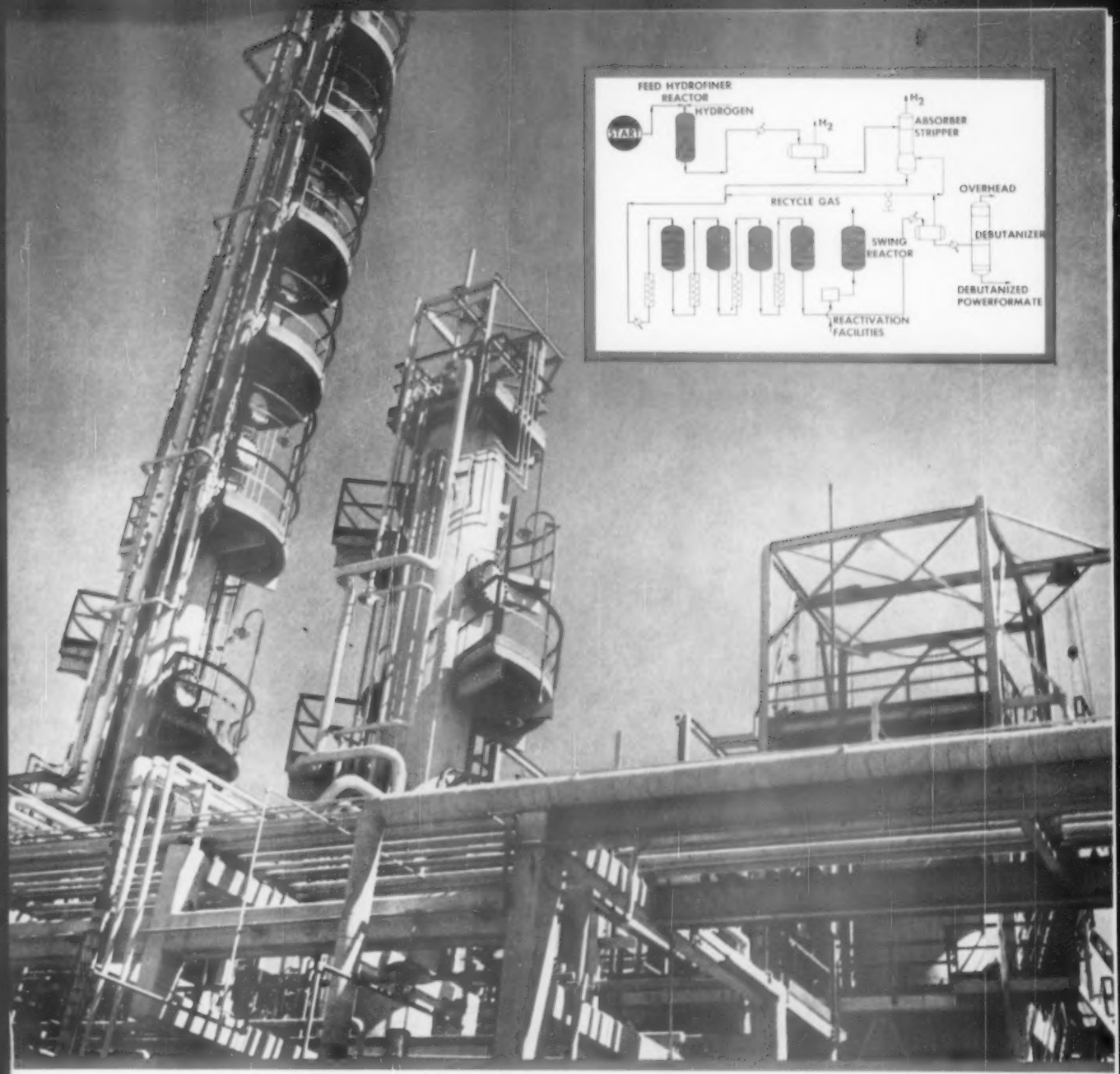

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Esso Research and Engineering Company offers you *Powerforming*, the most versatile platinum reforming process ever developed. *Powerforming* is another achievement of the Esso Research program – 37 years of new process developments which have been made available to refiners around the world.

Heart of the *Powerforming* process is a new, more active platinum catalyst. High activity over a long life is assured by significant new regenerative techniques. With this new process, good yields of 100 octane clear Powerformate can even be obtained from paraffinic stocks. Three *Powerforming* installations are on stream; eighteen are in the planning or construction stage. Licensees enjoy benefits of continuing *Powerforming* research. We would welcome your inquiry on the part *Powerforming* can play in *your* modernization plans.

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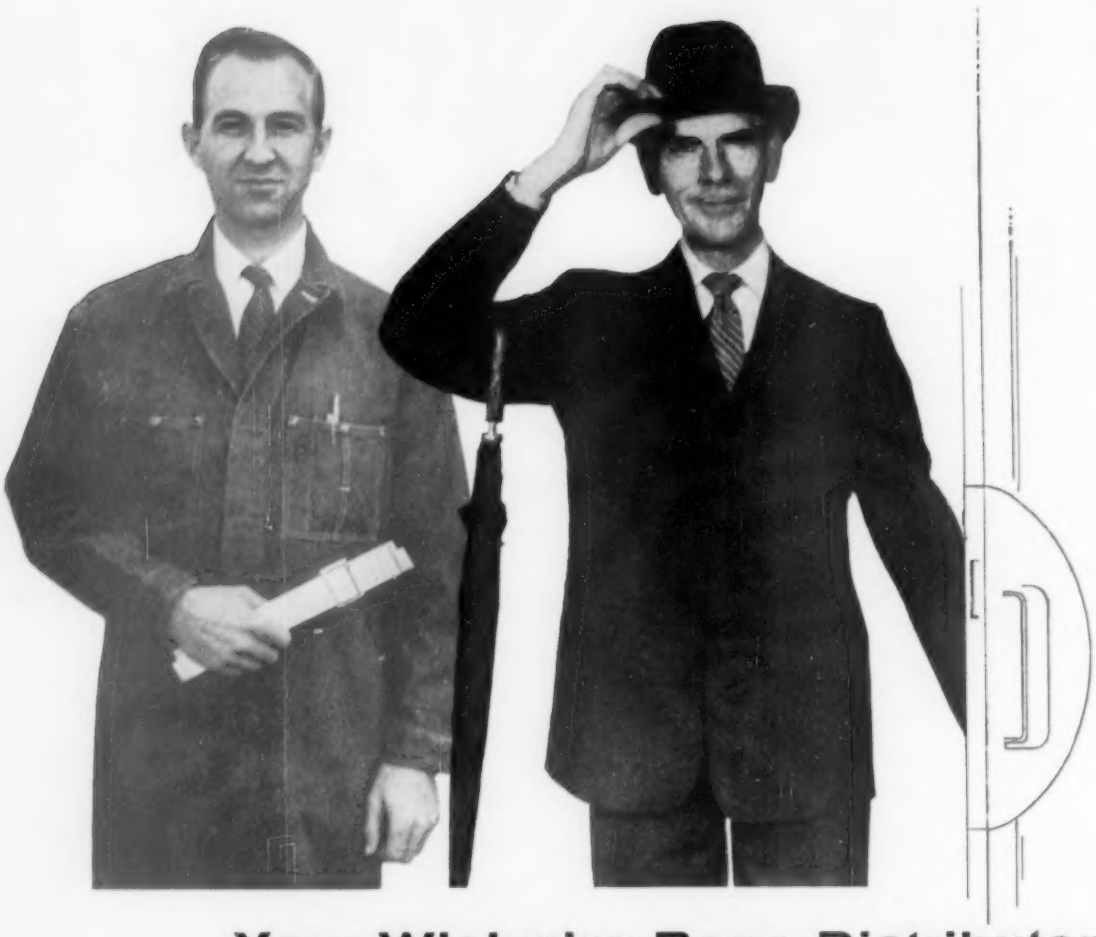

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This sales engineer—an expert on the selection, installation and maintenance of our products—is with your Wickwire Rope Distributor every time he makes a call.

True, sometimes he's hundreds of miles away, working in the field or at the mill. Yet, even if he's not there in person, your Wickwire Distributor has the full assurance that sales engineers such as this one are *always* quickly available to help you.

It's just one more reason why your Wickwire Distributor knows he's got top-quality wire rope, slings and strand to sell . . . and that these products will serve you well.

4086

A PRODUCT OF THE COLORADO FUEL AND IRON CORPORATION

Eddie and Bus Hughes have compiled an imposing number of service jobs during the time they've been with BJ Service, Inc. Together these Hughes brothers have put in over twenty-seven years' service and completed over 7300 jobs. But don't get the Hughes boys wrong. Jobs aren't just another mark on the wall to them. The big goal with Bus and Eddie is satisfying the customer. They're more interested in building a reputation based on satisfied customers than in completing a million jobs.

Theirs is a simple formula for making a customer happy. They give him "extra service"—service that you won't find listed on the cementing order they carry out to the job. Bus says, "I try to stay alert to the customer's needs and be as helpful as I can at all times." Eddie talks about "all-out cooperation" but regardless of how you say it, it all adds up to doing more than the customer ordered.

This extra service is something that all BJ Service men pride themselves on giving to their customers. Call for this experienced, more-than-asked-for service on your next cementing, well-stimulation or wire line job. Call the men who make service... BJ Service, Inc.!

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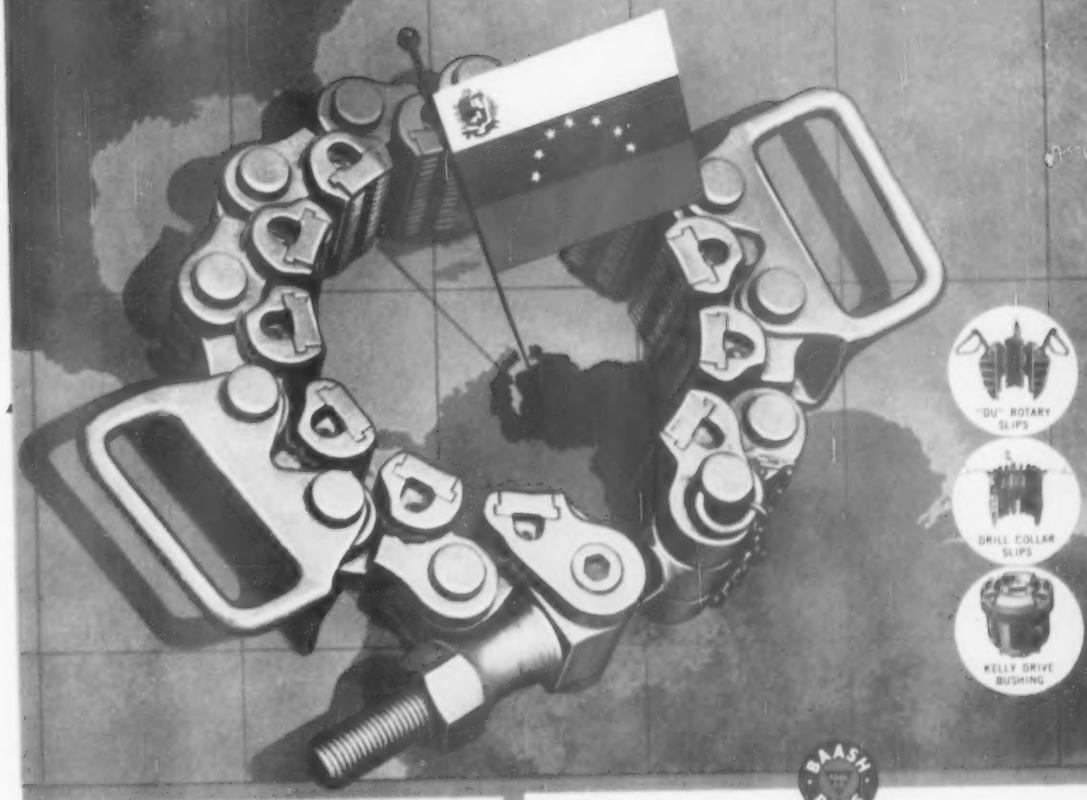

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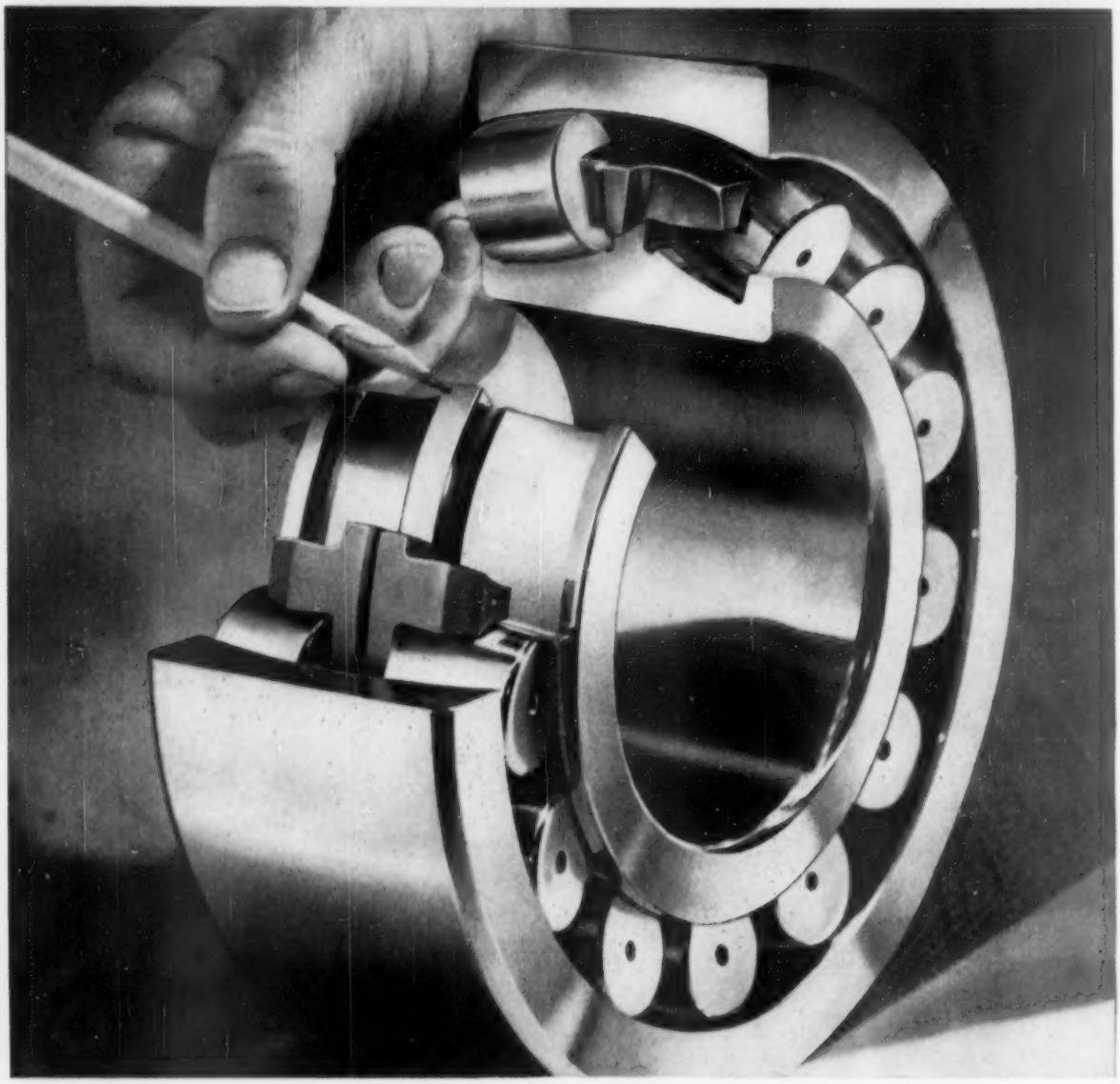
TORRINGTON *SPHERICAL ROLLER* BEARINGS



"This flange guides the rollers to peak performance!"

The center flange on the inner raceway of the TORRINGTON Spherical Roller Bearing positions the rollers to handle thrust loads. This accurate positioning also assures radial stability of the rollers under heavy loads—even at continuous high speeds and under conditions of misalignment.

This superior design feature is only one of many advantages you get when you specify TORRINGTON. For example, you get the service of TORRINGTON'S experienced engineers, who will help you with design and maintenance problems—or design custom bearings for special applications.

For long, low-maintenance service in heavy-duty applications, order TORRINGTON Spherical Roller Bearings. They're available from stock with either straight or tapered bore, for shaft or adapter mounting.

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MORE HOLE PER DOLLAR

...that's what Penrod is set up to offer you. Whether your program calls for drilling on inland waters, offshore, or on land, you'll realize a big saving in the overall cost, including mud...with Penrod on the job.

CONTINUOUSLY IMPROVED EQUIPMENT AND METHODS

THOROUGHLY EXPERIENCED ORGANIZATION

INDIVIDUAL SUPERVISION OF EACH RIG

2-WAY RADIO ON ALL EQUIPMENT

MODERN HOUSING FOR OPERATING PERSONNEL

HIGH PRESSURE PUMPS ON ALL RIGS

USE OF MAXIMUM DRILL COLLAR WEIGHT

CALL, WIRE OR WRITE TODAY
FOR MORE HPD ON YOUR NEXT WELL

PENROD DRILLING COMPANY

D. K. (DEWEY) DAVIS, DRILLING SUPERINTENDENT

TELEPHONE 3-1601

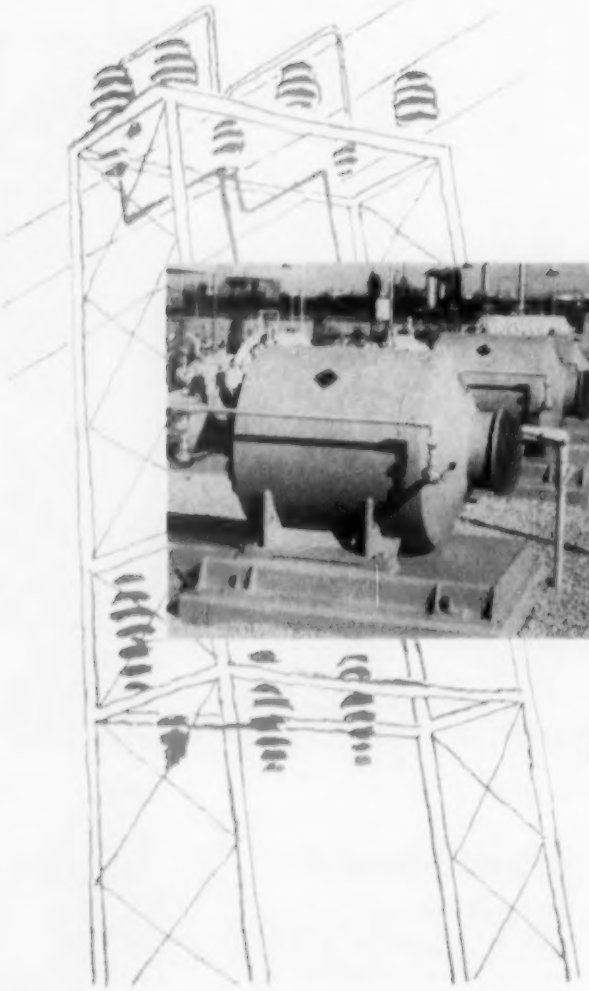
418 MARKET STREET SHREVEPORT, LOUISIANA

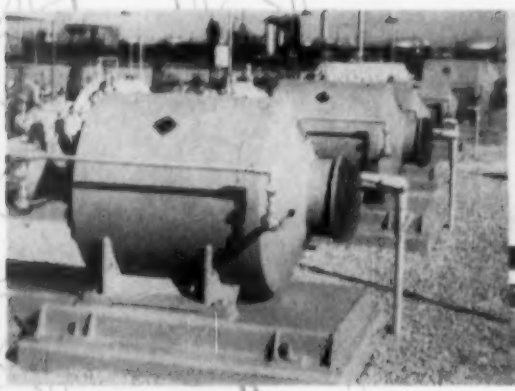
PENROD LAND AND SEA DRILLING COMPANY

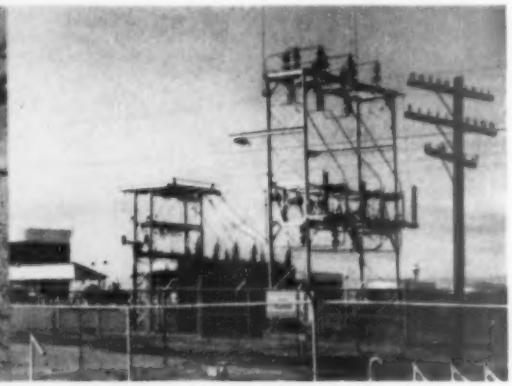
more than 350 pipeline stations are completely ELECTRIFIED . . .

WHY? Because Low Cost Purchased Electric Power handles the biggest jobs — pipe lines or multiple pumps — with trouble-free efficiency. Regardless of the job, Electric Power is your best bet. Operators of pipeline stations have found that for whatever the job . . . Electric Power gives them the advantages of low operating, maintenance, and labor costs . . . fast starting in all weather . . . and automatic control systems. Yes, with Electric Power . . . you get big savings.

Call your nearest Electric Utility Company for facts on how LOW COST Electric Power can serve you.

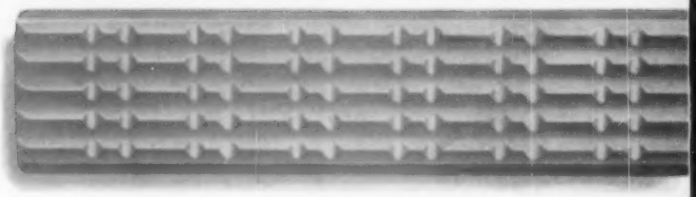


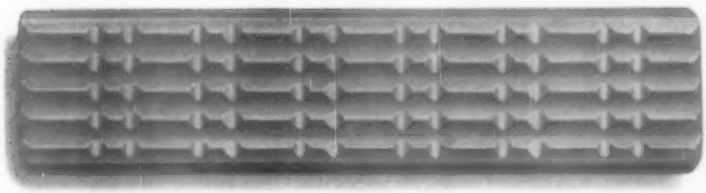


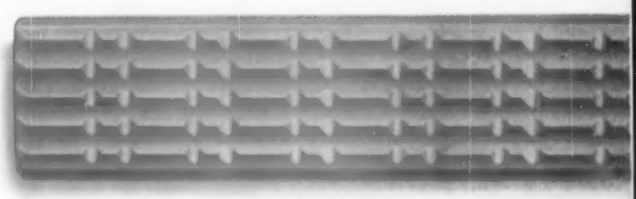


PETROLEUM ELECTRIC POWER ASSOCIATION

P.O. Box 2771, Dallas, Texas



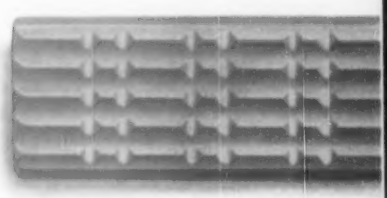




Quality **TONG DIES**

. . . are not hard to identify, and they are easy to find at your supply store. Just be sure you get the black and yellow box containing these yellow Tiger Tooth Tong Dies. The tiger head and WEB WILSON are stamped on the back of each die.

It's easy to prove their QUALITY, too. Install them in *any* rotary tongs and discover for yourself that they DON'T SLIP—they LAST A LOT LONGER, and cost FAR LESS in service.



WEB WILSON
OIL TOOLS, INC.

DALLAS • LOS ANGELES • NEW YORK

T F

TAYLOR

Welding nozzles

T.E.M.A. flanges and channels

Multiple outlet headers

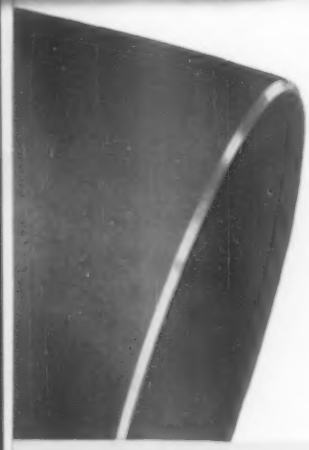
Production forgings

Venturi reducers

Spiral weld pipe

Large diameter electric weld pipe

Welding necks



By any method of value analysis...
By any measurement of quality...
By any standard of comparison...

IT PAYS TO BUY

FORGE

Welding Fittings and Forged Flanges

There are good, sound reasons for the high esteem in which Taylor Forge Welding Fittings and Forged Flanges are held everywhere . . . why they always "measure up" in any comparison of quality or value.

The dimensional accuracy, excellent metallurgical properties and fine design of these products are the result of Taylor Forge's fifty odd years of experience in the forging and forming of metal, in research and in the development of techniques, skills and production facilities.

That's why . . . for everything in Welding Fittings and Forged Flanges . . . every type, size, thickness, material and pressure rating . . . it pays to turn to Taylor Forge . . . TRADITIONALLY DEPENDABLE

Taylor Forge & Pipe Works

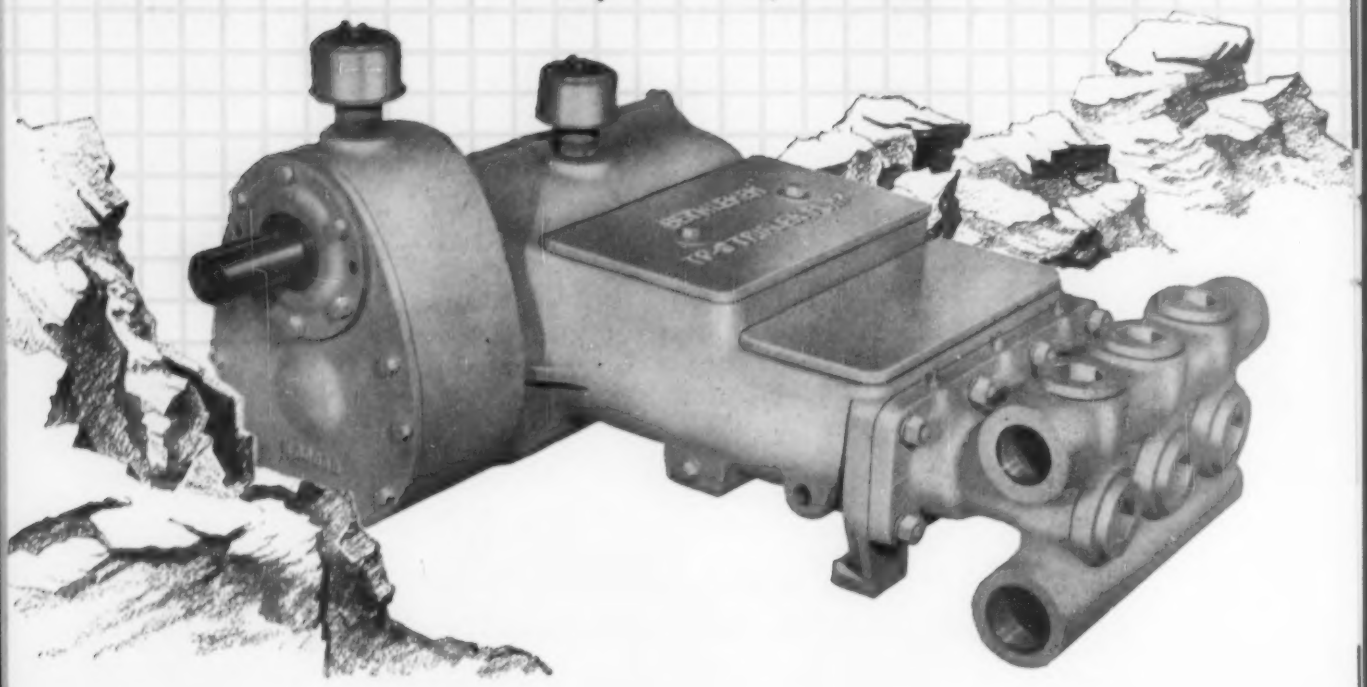
General Offices and Works: P. O. Box 485, Chicago 90, Illinois

Plants at: Carnegie, Pa., Gary, Ind., Houston, Texas, Fontana, Calif., Hamilton, Ont., Canada

District Sales Offices: New York, Boston, Philadelphia, Pittsburgh, Atlanta, Chicago, Houston, Tulsa, Los Angeles, San Francisco, Seattle, Toronto, Calgary.

To take full advantage of both product excellence and fine service patronize your local Taylor Forge Distributor.

Rugged as Rock and Superbly Engineered...



Bethlehem Triplex Pumps

In its expanded line of power pumps, Bethlehem now features two triplex models – the TP-3 and the TP-4. They are pumps intended for a wide range of applications, including waterflooding, salt-water disposal, crude-oil gathering, and the handling of refinery and LPG products.

These units are exceptionally sturdy, with every component designed for long, economical service. In each model the rugged power end, with its generous flood lubrication, is built to withstand continuous full-load rating. A choice of fluid ends is available, these being furnished in molybdenum alloy iron, cast steel, and aluminum-bronze, together with the proper trim. Plungers are of hardened steel, stainless steel, or solid ceramic.

For complete flexibility the pumps can be fitted with a Bethlehem-built speed-reducer. This accessory, which is optional, can be installed at the plant or easily added at field location.

The TP pumps are beautifully engineered, and they will serve you dependably for very few dollars per horsepower. Full information is available through the nearest Bethlehem office or store. We suggest you check with us when considering pumps of this type.

QUICK FACTS ABOUT THE TP's:

Model	Type	Plunger Load, Lb	Pressure Range, PSI	Input Hp	Bore and Stroke, In.
TP-3	Triplex	3580	900 – 1500	22.4 @ 250 rpm	1¾ to 2¼ x 3
TP-4	Triplex	5000	400 – 1590	42 @ 250 rpm	2 to 4 x 4

BETHLEHEM SUPPLY COMPANY

General Offices: 21 E. Second St., Tulsa, Okla.

West Coast Headquarters: Los Angeles, Calif.

Export Distributor: Bethlehem Steel Export Corporation
25 Broadway, New York, N. Y.

BETHLEHEM STEEL

BETHLEHEM SUPPLY

What do you want in a drilling mud that . . .

BLACK MAGIC

doesn't have?

NO HARMFUL FILTRATES?—BLACK MAGIC is made with refined oil. It can pick up as much as 25% or more water by volume without losing water into the formation. Water content is held tightly in emulsified form. API Filtrate loss is zero for sixty minutes. Highest return permeability of any drilling mud!

EXCELLENT PLASTERING PROPERTIES—BLACK MAGIC maintains a slick hole, lays down an extremely thin wall cake and reduces torque through drill stem lubrication. BLACK MAGIC's thin mud cake disintegrates in crude oil when well is completed.

CORES AS NATURE MADE THEM?—BLACK MAGIC offers excellent core recovery even in the softest formations. Connate water is not flushed out and core analysis gives true values. In unbiased tests, return permeability is as high as 98% when BLACK MAGIC is used.

GREATER VERSATILITY?—BLACK MAGIC can be weighted as desired—from 7.5 lbs/gal to 21.4 lbs/gal—yet still retains a readily pumpable viscosity. BLACK MAGIC is unaffected by salt, hydrogen sulfide, gypsum, anhydrite or any other calcium or magnesium ions that adversely affect other drilling fluids. In the deepest, hottest holes, BLACK MAGIC's superior properties are really outstanding. BLACK MAGIC's small diesel oil filtrate is compatible with formation crudes and thus BLACK MAGIC does not block off return permeability. BLACK MAGIC is the most ideal workover fluid available!

LOW COST MAINTENANCE?—BLACK MAGIC is easy and inexpensive to regenerate with OBI chemicals. Systems used as long as eight years are still in operation. BLACK MAGIC remains stable under the most severe hole conditions. It can be stored indefinitely. Extremely high weights are maintained at minimum cost since formations drilled do not dilute this mud.

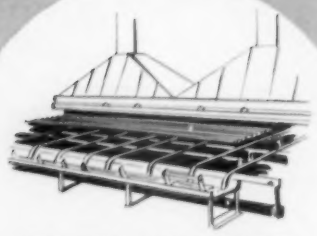
Of course, you want all these qualities in your drilling mud. The way to be sure you get them ALL, *plus* other exclusive advantages, is to specify BLACK MAGIC . . . the first successful oil base mud commercially available . . . backed by the broadest, longest success record of them all.

Call your nearest OBI Representative. He has complete data for you.

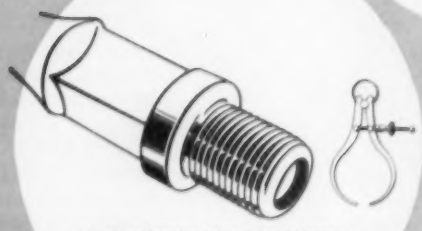
OIL BASE, INC.

PLANTS IN: Houston • Odessa • Duncan • Bakersfield • Compton
BRANCHES IN: Houston • Odessa • Corpus Christi • Oklahoma City • Duncan • Lafayette • Harvey • Bakersfield • Long Beach • Ventura
REPRESENTATIVES IN: Mexico City • Caracas • Lima • Bogota • Calgary • Paris. CABLE ADDRESS: OBI

PRECISION FORGING of each rod assures lasting service.



CONTROLLED Full Length NORMALIZING AND TEMPERING, another Jones First, adds strength and endurance.



ACCURATE THREADING is the key to the "Jones Joint" for better make-up, longer service.

MADE TO LAST LONGER

For the long run, Jones Sucker Rods are your best buy. They are a precision-made product of selected steels —designed for maximum service under every condition. The experience of over 60 years is built into every rod. Why accept less than the best?

JONES
SUCKER RODS

Look for the "GREEN" Rods

PESA — PARTNERS IN PETROLEUM PROGRESS

THE S. M. JONES COMPANY
Division of Buffalo-Eclipse Corporation

General Office and Factory: **TOLEDO, OHIO**
Sales Office: Kennedy Building, **TULSA, OKLAHOMA**
Export Sales Representatives: IDECO—Division of Dresser Equipment Company, Republic National Bank Building, Dallas, Texas and Chanin Building, New York City

It takes a complete team to keep dependable drilling mud service available for you

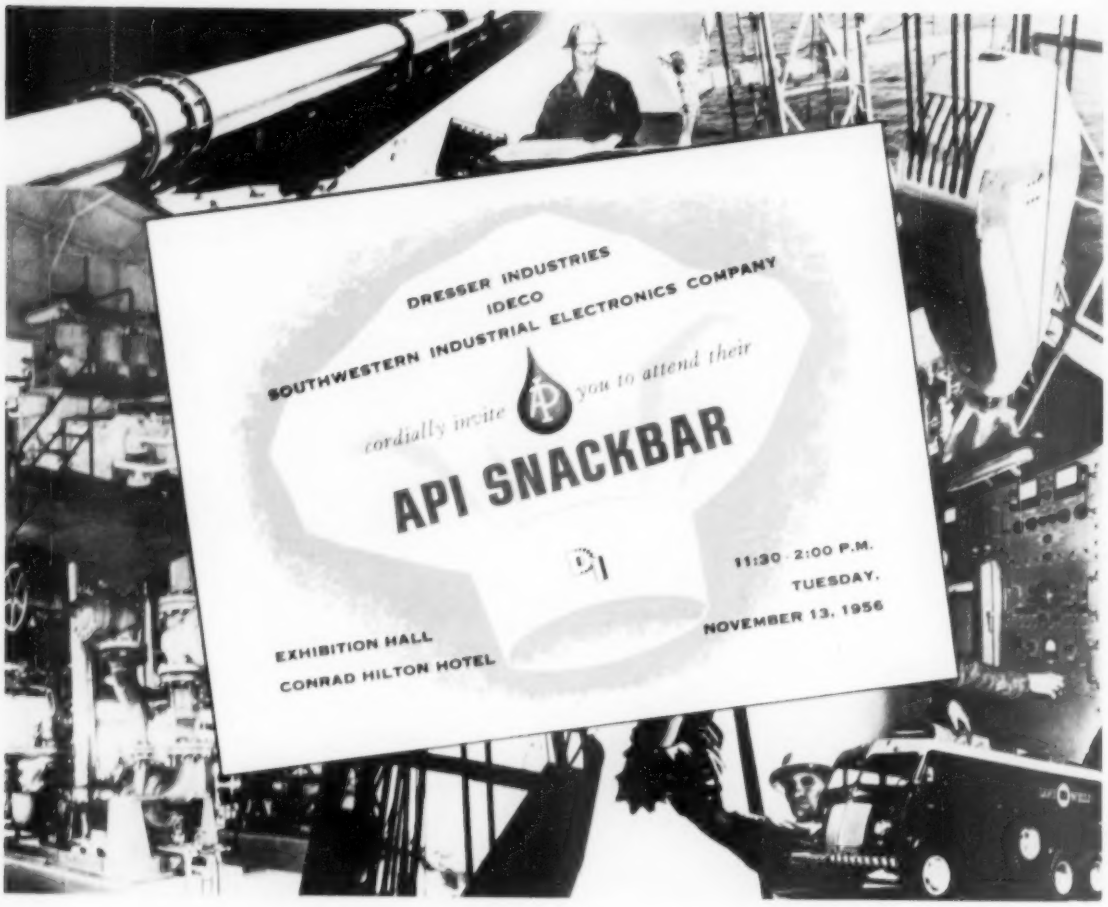
Meet this Magcobar Man, the member of the team who actually delivers the goods

Your Magcobar Dealer has hitched his future to the oil industry. He's an independent, local businessman who has elected to represent Magcobar in the field because he's convinced of the quality, resources and field service facilities in which Magcobar has invested millions of dollars to back up his stocks of materials. When you need mud, look for the Magcobar Dealer. He's the "front man" of a complete Magcobar team. He's ready to serve you with the most complete line of drilling mud products and service in the field.

Magcobar
Complete
DRILLING MUD SERVICE

MAGNET COVE BARIUM CORPORATION

Houston, Texas



Plan to Meet Your Friends at the API Snackbar

AMERICAN PETROLEUM INSTITUTE

36TH
ANNUAL MEETING

Conrad Hilton Hotel
Palmer House
Chicago, Illinois
November 12-15, 1956

Dresser pays tribute to the members of the American Petroleum Institute for their many contributions to the progress of our vital oil and gas industries.

THE DRESSER INDUSTRIAL TEAM SERVES THE GROWING OIL

the Dresser Badges of Merit plus+

CLARK

CLARK BROS. CO., Olean, New York —Gas turbines, engines, and reciprocating, centrifugal and axial flow compressors—gas, steam, electric and diesel driven.

DRESSER IDECO

DRESSER-IDECO COMPANY, Columbus, Ohio—Radio and television broadcasting towers, steel buildings, aircraft hangars, electric power substations.

DRESSER MANUFACTURING DIVISION

DRESSER MANUFACTURING DIVISION, Bradford, Pa.—Pipe line couplings, pipe repair sleeves and clamps, weldments, forgings, welding fittings, flanges, rings.

IDECO*

IDECO, Dallas, Tex.—Hydrair* and Power Rigs; Full-View* Masts; substructures; single, dual and Drive-In Rambler Rigs; blocks, swivels, rotaries; mud pumps; petroleum equipment and supplies.

LANE-WELLS

LANE-WELLS CO., Los Angeles, Calif., Houston, Tex., Oklahoma City, Okla.—Electric and Radioactivity Well Logging, Koneshot* perforating and bullet perforating, bridging plugs.

Magcobar

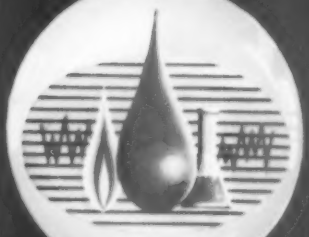
MAGNET COVE BARIUM CORP., Houston, Tex.—Magcobar* and Magcogel* drilling muds and other specialized oil well drilling fluids and chemicals.

PACIFIC

PACIFIC PUMPS, INC., Huntington Park, Calif.—Centrifugal pumps for refineries, power stations, pipelines, and chemical plants; plunger pumps for oilwells.

ROOTS-CONNERSVILLE

ROOTS-CONNERSVILLE BLOWER DIVISION, Connersville, Ind.—Rotary positive blowers, gas pumps, centrifugal blowers, exhausters, vacuum pumps, and positive displacement meters.



Security

SECURITY ENGINEERING DIVISION, Dallas, Tex., Whittier, Calif.—Rock bits, reamer rock bits and hole openers; reamers, casing scrapers and Neo-Red rubber stabilizers.

SIE

SOUTHWESTERN INDUSTRIAL ELECTRONICS CO., Houston, Tex.—Seismograph systems and instruments—electronic, electro-mechanical. Computers—analog and digital; recording systems. Special transformers, reactors.

GUIBERSON

GUIBERSON CORPORATION, Dallas, Tex.—Oil tools; packers, anchors, workover equipment — drilling heads, blowout preventers, tubing blocks, hooks, swivels, kellys, savers, unions. Gas lift equipment. Molded rubber products.

*Trademark registered

put this DRESSER *plus+* family to work for you!

You receive a bonus of extra value whenever you are served by any one of the Dresser companies. Each Dresser operating unit provides the research, engineering, manufacturing and service applications for its particular specialties. *All* work together to provide the combined experience and facilities of the world-wide Dresser industrial team. This inter-company teamwork offers a bonus in greater experience and technical knowledge—backed by the extensive Dresser facilities—in the customer's specific industry. This intangible but important factor is known throughout the world as the Dresser plus +... the mark of superior equipment and services for the oil, gas, chemical, electronic, and general industry.

Dresser's world-wide engineering experience in many industries plays a major role in the creation of new developments and improved technological methods. No other single company provides the same broad range of equipment and services. The Dresser plus + is a symbol for the superior quality of equipment and technical services which have become the standard of comparison in industries the world over!

DRESSER INDUSTRIES, INC.

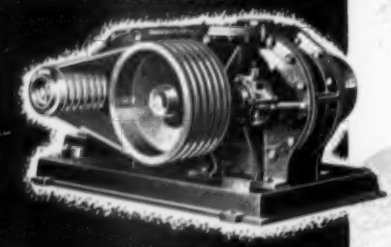
EQUIPMENT AND TECHNICAL SERVICES

OIL • GAS
CHEMICAL
ELECTRONIC
INDUSTRIAL

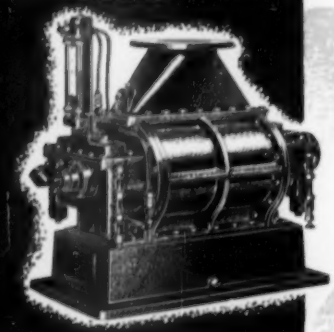
POST OFFICE BOX 718 • REPUBLIC NATIONAL BANK BUILDING • DALLAS 21, TEXAS

GAS, CHEMICAL AND ELECTRONIC INDUSTRIES — *EVERYWHERE*

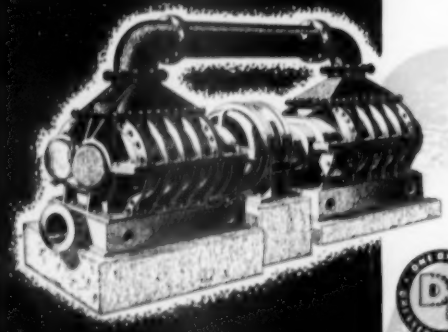
CENTRIFUGAL or Rotary Positive Blowers and Exhausters can move from 5 cfm to 100,000 cfm of air for many diversified needs. For complete details, send for Bulletins 120-B-14, AF-154 and RB-154.



GAS PUMPS can be applied to many industrial uses where from 5 cfm to 50,000 cfm are needed. Send for Bulletins 31-B-17 and 32-33-B-13 for full information.



METERS measure gas up to 1,000,000 cfh or as little as 4,000 cfh with constant accuracy. For specifications and capacity tables, send for your copy of Bulletin M-152.



VACUUM PUMPS with exceptionally low operating cost range in capacity from 500 cfm to 13,000 cfm, and up to 24" Hg vacuum. Complete information in Bulletin 50-B-13.

Production roadblocks avoided by ingenious use of air or gas

Alert industrial engineers and designers are finding new ways to put gas and air to work more effectively. They take delays out of industrial processing and improve quality. They add new utility to devices and appliances for commercial and home use.

...in many different applications

they are utilizing the many advantages of Roots-Connersville equipment. They move large or small volumes of air and gas with Blowers, Exhausters and Gas Pumps ... produce vacuums ... meter gas for proportioning or other measuring needs ... protect plants against fire and explosion with Inert Gas Generators. Solutions of specific problems are often solved faster and better when

...assisted by Roots-Connersville ideas

These are the result of more than 100 years of knowledge and are available to any user of gas or air, or equipment builders who need them. If you have a product or a process which might be improved by our mutual effort, we'll gladly work with you.

Just address:

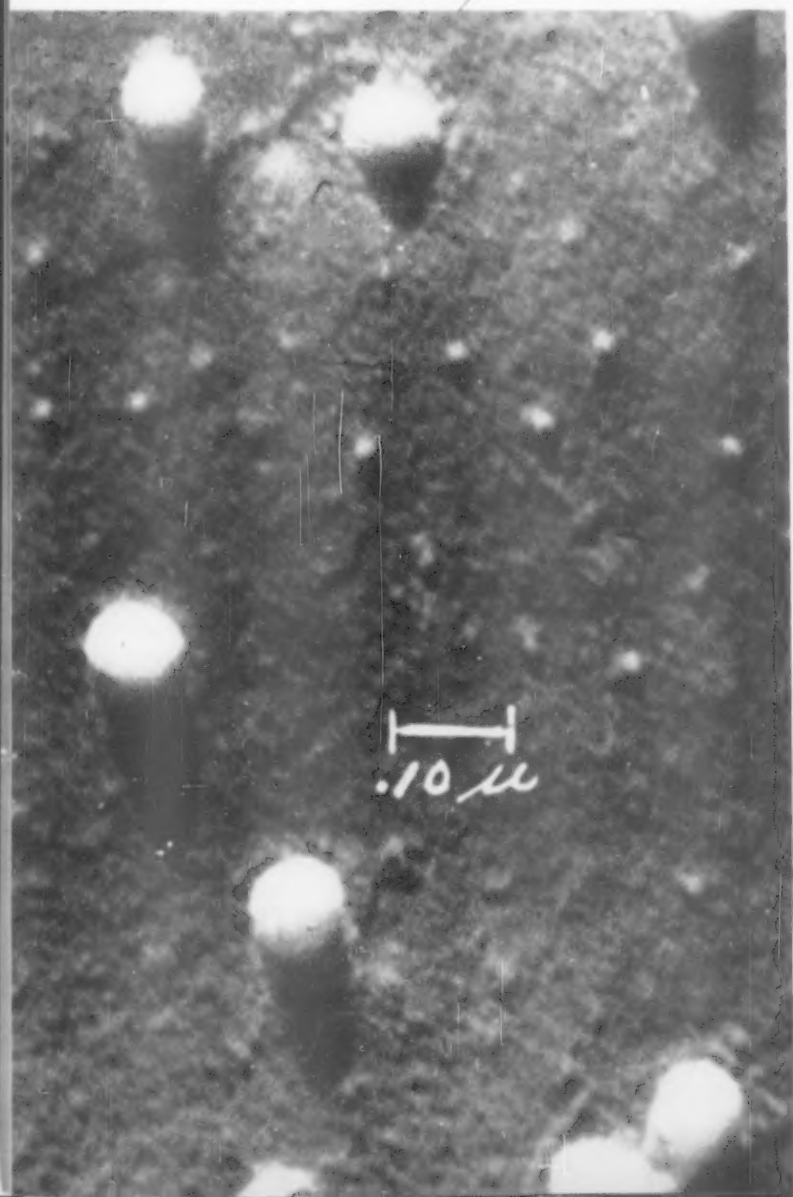
Product Development Manager, Roots-Connersville Blower Division
1156 Oak Avenue, Connersville, Indiana

ROOTS-CONNERSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC.

MEASURING THE UNSEEN

Influenza virus magnified 78,570 times by an electron microscope. The unit of measure shown, 0.1 μ, is 1/10,000 millimeter.



Tuboscope research in its field has been as imaginative and rewarding as the electron microscope has been in its field.

With instruments developed by Tuboscope research, Tuboscope technicians are able to measure the unseen ravages of wear, fatigue, and corrosion in oilfield tubular goods. These instruments, coupled with Tuboscope's years of experience, assure you of the best and the newest in proved methods of non-destructive inspection in the field.

The important elements of bottom hole temperature and pressure can likewise be measured by the Subsurface Engineering Division.

Tuboscope COMPANY

2919 HOLMES RD.
HOUSTON, TEXAS

Buried any treasure lately? If so, did you protect it with BLUE FLAG?

Don't let underground corrosion rob your company of huge pipeline investments. For less than one-half of one per cent of the original cost, you can protect pipelines with Blue Flag Pipe Wrap.

L·O·F Glass Fibers' Blue Flag is made of special inert glass which resists the destructive action of soil chemicals. A Blue-Flag reinforced coating will extend pipeline-life years longer than unreinforced coatings.

What's more, Blue Flag greatly increases wrapping efficiency. High tensile strength virtually eliminates breakage . . . uniform porosity keeps "holidays" to a minimum . . . enamel cold flow is retarded, while strength is increased . . . pipeline coating is protected from backfill damage.

Blue Flag Reinforcing Pipe Wrap is available from a nearby distributor-warehouse. For full details, write: L·O·F Glass Fibers Company, Dept. 78-116, 1810 Madison Avenue, Toledo 1, Ohio.

LOF GLASS FIBERS
BLUE FLAG
PIPE WRAP

L·O·F GLASS FIBERS COMPANY

TOLEDO 1, OHIO

Makers of glass fibers by the "Electronic-Extrusion" process

For Complete Pipeline Protection, use: BLUE FLAG Reinforcing Pipe Wrap • **DURAMAT** Protective Outer Wrap • **DURAMESH** Pipeline Fabric • **DURATAPE** Pipeline Joint Wrap

What Kind of a Pipeline Job Have *You* Got?

HERE'S the Muskrat Line—Tennessee Gas Transmission's coastal line. It's practically a combat operation with the lay barge and its equipment as the work horse. Here a lay barge with a Northwest Model 95 as its main piece of equipment is making a tie-in at a main line valve platform.

Jobs like this call for dependability and versatility. Northwests are always ready to go. They bring you a range of boom hoist equipment for any condition. Uniform Pressure Swing Clutches take the jerks and grabs out of swinging and make spotting the load easier. Northwest positive traction on both crawlers while turning as well as when going straight ahead make steering a big rig easier. The "Feather-Touch" Clutch Control gives the *feel of the load* and reduces fatigue without resorting to delicate pumps and compressors that often require special knowledge to keep in order. These and many other Northwest advantages help do the job faster at lower cost.

HERE is one of R. H. Fulton's many Northwests on one of the many jobs he is handling.

Pullshovel work on a pipeline job may look easy but it takes stamina in both men and machines to stand up under the conditions that often develop. Heat, dust and dirt, and the wear and tear of miles of travel can be met profitably only by the best of equipment.

Northwest Pullshovels have been proved on miles of pipeline work. Northwest crawlers with their self-cleaning action stand up in the up and down hill travel. Easy steering gives smooth control in "leap frog" operations and in crossing and straddling ditch.

But most important of all is that outstanding ability of Northwests to always be ready to go with digging ability to meet any condition.

PRODUCTION PLUS MEANS MONEY

GS-14.5CG

NORTHWEST ENGINEERING COMPANY
1517 Field Building, 135 South LaSalle Street
Chicago 3, Illinois

NORTHWEST

CRAWLER and TRUCK MOUNTED SHOVELS • CRANES • DRAGLINES • PULLSHOVELS

Northwest builds a range of sizes from the Model 25, ¾ cu. yd. capacity up to the Model 95. Here is a range of sizes that will meet every oil field lifting and excavating problem. Many of the leading pipeline contractors and oil companies are Northwest repeat order buyers.

ANNOUNCING

2 GREAT PRODUCTS TO SAVE HIM

OIC PLUG VALVES & AMERICAN METER

An unbeatable gas flow-control and measurement combination

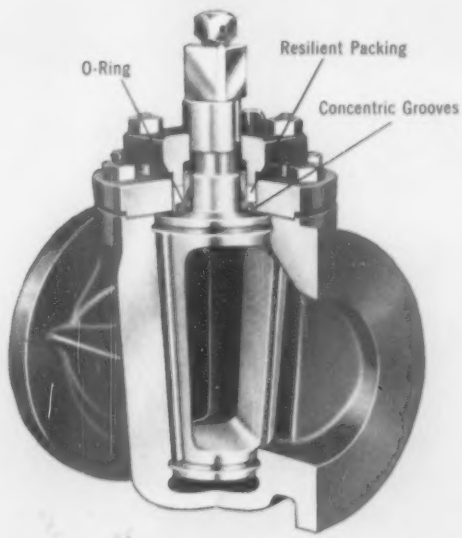
OIC's exclusive, triple-seal lubricated plug valve design is a perfect complement to the dependable quality of American Meter's top line of measurement and control equipment.

OIC VALVES

FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES

JOIN FORCES

MAINTENANCE TROUBLES



Exclusive OIC triple seal ends shank and gland leaks . . . retains adjustment

Concentric grooves form a *labyrinth seal.* Gland liner also retains an *O-ring*—a second seal. *Resilient packing* forms a third seal, is completely isolated from all moving parts.

These three seals act separately from the valve's lubrication system to prevent gland and shank leakage. Lubrication in grooving surrounding body ports, plus lube film on body and plug surface provides a positive seal between plug and body.

Maintenance-free metering to fit your needs

Make your choice from American Meter, the only manufacturer of a complete line of precision measurement and control equipment for the gas, oil and chemical industries. And now American Meter serves you even more completely, offering you the OIC line of lubricated plug valves stocked at strategic locations for prompt delivery.

Ironcase

Welded Steelcase

Aluminumcase

Tinned Steelcase

AMERICAN METER COMPANY

INCORPORATED ESTABLISHED 1836

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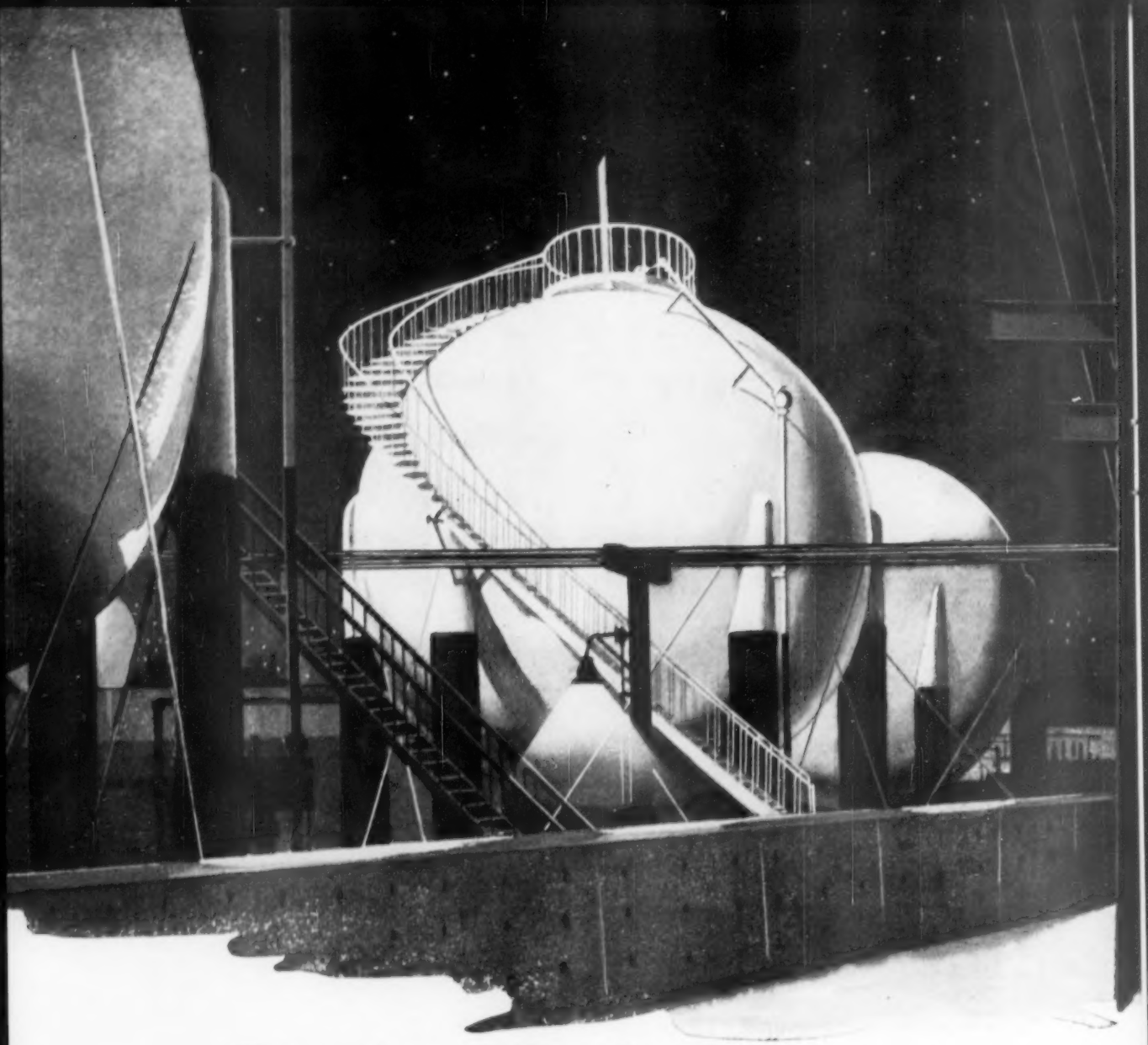
SUPPLIERS TO THE GAS INDUSTRY for Ironcase, Tinned Steelcase, Aluminumcase and Welded Steelcase Meters • American-Westcott Orifice Meters • Instruments • Reliance Regulators • Provers • Apparatus



Petroleum Products...

and Beacon Petroleum Company

The successful marketing of today's petroleum products depends upon an experienced organization. Behind Beacon are years of successful operation... your assurance of dependable service.

If you have Butane-Propane, Deisel Fuel, Natural Gasoline or any other petroleum products to sell contact Beacon . . . or if you want to buy any petroleum products . . . contact Beacon.

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MARKETERS OF NATURAL GASOLINE, BUTANE-PROPANE, MOTOR FUEL, FUEL OILS

for Dependability and Economy Standardize on RED SEAL POWER

CONTINENTAL MOTORS · Powerful as the Nation · AMERICA'S STANDARD ®

The petroleum industry's widening use of Red Seal engines traces mainly to two factors. One is the broad diversification of the Red Seal line—more than 100 basic models, from 14 h.p. to 1,000-plus*, for use on all standard fuels . . . The other is Continental's long standing reputation for dependability—their inbuilt capacity to deliver more power, longer, at lower cost. Ask for them at your supply store.

*High-output air-cooled military models developed jointly by Army Ordnance and Continental are now available for commercial applications where high output (375 to 1,000-plus h.p.) low weight, and exceptional compactness are required. For information, address Continental Motors Corporation, Military Division, 76 North Getty Street, Muskegon, Michigan.

1955 WINNER NATIONAL SAFETY COUNCIL PUBLIC INTEREST Award

PARTS AND SERVICE EVERYWHERE

GASOLINE AND LPG ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Base Engine H.P.
N56	4	2¼	3½	56	14.4 @ 2200 RPM
N62	4	2¼	3½	62	15.3 @ 2200 RPM
Y69	4	2½	3½	69	21.4 @ 2400 RPM
Y91	4	2⅞	3½	91	28.5 @ 2400 RPM
Y112	4	3 1/16	3½	112	32.0 @ 2400 RPM
F124	4	3	4⅛	124	36.5 @ 2400 RPM
F140	4	3 1/16	4⅛	140	42.0 @ 2400 RPM
F162	4	3 1/16	4⅛	162	49.0 @ 2400 RPM
F186	6	3	4⅛	186	60.5 @ 2400 RPM
F209	6	3 1/16	4⅛	209	68.0 @ 2400 RPM
F226	6	3 1/16	4⅛	226	73.0 @ 2400 RPM
F244	6	3 1/16	4⅛	244	79.0 @ 2400 RPM
M271	6	3⅛	4⅛	271	86.2 @ 2400 RPM
M290	6	3⅛	4⅛	290	92.2 @ 2400 RPM
M330	6	4	4⅛	330	104.4 @ 2400 RPM
M363	6	4	4 15/16	363	128.9 @ 2800 RPM
B371	6	4⅛	4⅛	371	110.0 @ 2400 RPM
B427	6	4 5/16	4⅛	427	127.0 @ 2400 RPM
G134	4	3⅛	4⅛	134	34.2 @ 2000 RPM
G157	4	3⅛	4⅛	157	40.0 @ 2000 RPM
E201	4	3⅝	4⅛	201	65.4 @ 2400 RPM
H227	4	3⅞	5½	227	54.0 @ 1800 RPM
H243	4	3⅞	5½	243	57.9 @ 1800 RPM
H260	4	3⅞	5½	260	62.0 @ 1800 RPM
H277	4	4	5½	277	66.4 @ 1800 RPM
K363	6	4	4 15/16	363	123.0 @ 2400 RPM
J382	4	4½	6	382	74.0 @ 1400 RPM
T371	6	4⅛	4⅛	371	119.0 @ 2400 RPM
T427	6	4 5/16	4⅛	427	140.0 @ 2400 RPM
U501	6	4½	5¼	501	159.0 @ 2400 RPM
R513	6	4½	5½	513	164.3 @ 2400 RPM
R572	6	4⅝	5½	572	182.4 @ 2400 RPM
R602	6	4⅝	5½	602	191.7 @ 2400 RPM
V603	8	4¼	4¼	603	220.0 @ 2800 RPM
S749	6	5¼	5½	749	217.0 @ 2200 RPM
S820	6	5¾	5½	820	237.0 @ 2200 RPM

CUSHIONED POWER DIESEL ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Base Engine H.P.
ZD129	4	3¼	3⅞	129	34.0 @ 2000 RPM
GD157	4	3½	4½	157	39.0 @ 2000 RPM
*ED201	4	3¾	4⅝	201	45.8 @ 2000 RPM
HD243	4	3¾	5½	243	55.0 @ 2000 RPM
*HD260	4	3¾	5½	260	59.0 @ 2000 RPM
*HD277	4	4	5½	277	63.2 @ 2200 RPM
*JD382	4	4½	6	382	72.5 @ 1600 RPM
TD427	6	4 5/16	4⅛	427	106.0 @ 2000 RPM
RD572	6	4¼	5¾	572	154.0 @ 2000 RPM
VD603	8	4¼	4¼	603	175.0 @ 2600 RPM
SD802	6	5 5/16	5½	802	202.0 @ 1800 RPM

*Available for industrial applications only.

Continental Motors Corporation

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6 EAST 45TH STREET, NEW YORK 17, NEW YORK • 6218 CEDAR SPRINGS ROAD, DALLAS 9, TEXAS • 3817 SOUTH SANTA FE AVENUE, LOS ANGELES 58, CALIFORNIA • 1282 OAKLEIGH DRIVE, EAST POINT (ATLANTA) GEORGIA

EMSCO

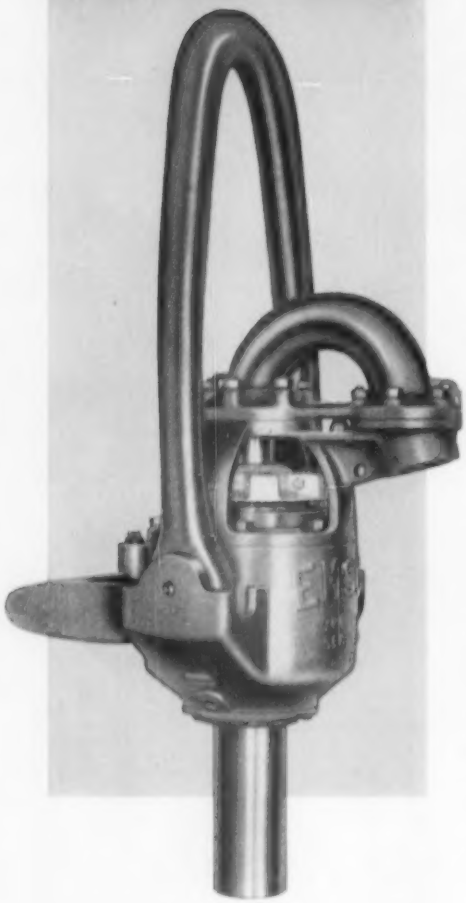
SWIVELS

FIELD TESTED

for extra speed, economy and safety

EMSCO

TRAVELING BLOCKS



EMSCO SWIVELS

Designed for easier, more economical handling, servicing and maintenance, Emsco "L" Series Swivels combine many important time and labor saving features. Reduced weight and height, increased hook clearance, improvement in bail design, replaceable bail pins, and high capacity, true-cone roller bearings spell trouble-free, dependable performance.

EMSCO TRAVELING BLOCKS

Safer and easier to operate, Emsco "R" Series Traveling Blocks are fast falling, straight traveling, and slimlined — with a low center of gravity that eliminates canting. Sheaves are made with rolled forged steel rims . . . grooves are flame hardened to reduce wire line wear.

There are Emsco Swivels and Traveling Blocks, as well as Crown and Hydra-Hook Blocks in a full range of sizes.

Call your nearest Continental store for all the facts.

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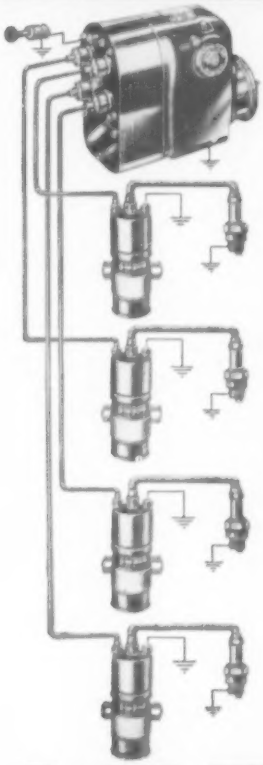


for Large Bore Stationary Gas Engines

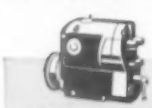
AMERICAN BOSCH

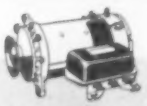
LOW TENSION MAGNETO IGNITION SYSTEM

The System comprises the American Bosch MRB Low Tension, shielded Magneto and individual High Tension Ignition Transformers mounted at each engine cylinder. (See 4 cyl. installation diagram at left). Low tension current, generated in the Magneto, is distributed through low tension leads to the Transformers. Here, the electrical energy is stepped-up to high voltage and conducted to the spark plugs by short cables—shielded if desired. The rugged, heavy-duty, high tension Transformers (as illustrated above) are available with or without shielding for use in the American Bosch System or other low tension systems employing magneto or battery ignition.

Energy losses and corona effects which occur with long high tension cables are eliminated. The possibility of fire and explosion hazard is minimized where engines operate in combustible vapors . . . radio and TV interference may be greatly reduced by complete shielding. These important advantages, combined with the outstanding electrical and mechanical features of the American Bosch Low Tension Magneto, offer maximum spark efficiency for large bore, stationary engines operating under severest conditions. For peak engine performance and safer, continuous service, get the facts from American Bosch, Springfield 7, Mass. A Division of American Bosch Arma Corporation.

AMERICAN BOSCH


Automotive and Aviation Magnetos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Components for Aircraft Engines

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oil men
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there's a touch of imagination in every good construction job

Brains, experience, technical skills, are all fundamental qualities in a good builder. These we have here at Procon in full measure. But, we try to add that vital touch of imagination that helps us visualize the correct answer to exacting new problems and enhances our ability to get each project completed to schedule and to every requirement.

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Here Now! NEW CHEVROLET
FIRST with the MOST

They're out to save you hours and dollars on any hauling job . . . and they've got big new power plus the modern features that make it a sure thing! They put you way ahead with time- and work-saving advantages you won't find in any other truck today!

Year after year—first with the most modern features! And again, for 1957, Chevrolet brings you the industry's most advanced truck features—new developments that have already been proved in a history-making preannouncement test run! (See below.)

For '57 there's bold new styling—rugged good looks to match Chevy's remarkable stamina and dependability. There's new

Alcan Highway Test Run Proves Chevrolet Ruggedness!

In an AAA-certified endurance run, 6 new Task-Force trucks roared up the 1,520-mile Alcan Highway (normally a 72-hour run) in less than 45 hours! In dramatic fashion, new Chevy trucks conquered one of the world's most challenging roads and proved their greatness!

A

TASK·FORCE 57 TRUCKS!

modern features

fleet-action power in Chevy's outstanding new engine line-up—with the 195-h.p. Loadmaster V8 standard in all 9000 and 10000 series trucks; and the sensational new 283-cu.-in. Taskmaster V8 (160 h.p.) standard in 5000, 7000 and 8000 series models. All told: *five* high-efficiency V8's and *three* economy-leader 6's in the truck line alone!

Many models are equipped with bigger, brawnier rear axles. And there's a load of heavy-duty options for '57 — including Chevy's revolutionary 6-speed Powermatic transmission, designed especially for heavy-load, high-mileage hauling.

Your Chevy dealer has all the details. When you see him, be sure to check the new cab features, too. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

The "Big Wheel" in trucks!

B

C

A. Cameo Carrier covered entire distance without stopping engine; averaged 18.17 miles per gallon!

B. New Super Taskmaster 283 V8 stole the power show, flattening an obstacle course of mud, gravel and grades!

C. 1,520 miles without shifting gears! Powermatic equipped heavyweight went all the way in a single forward-speed range!

Install it... then forget it!

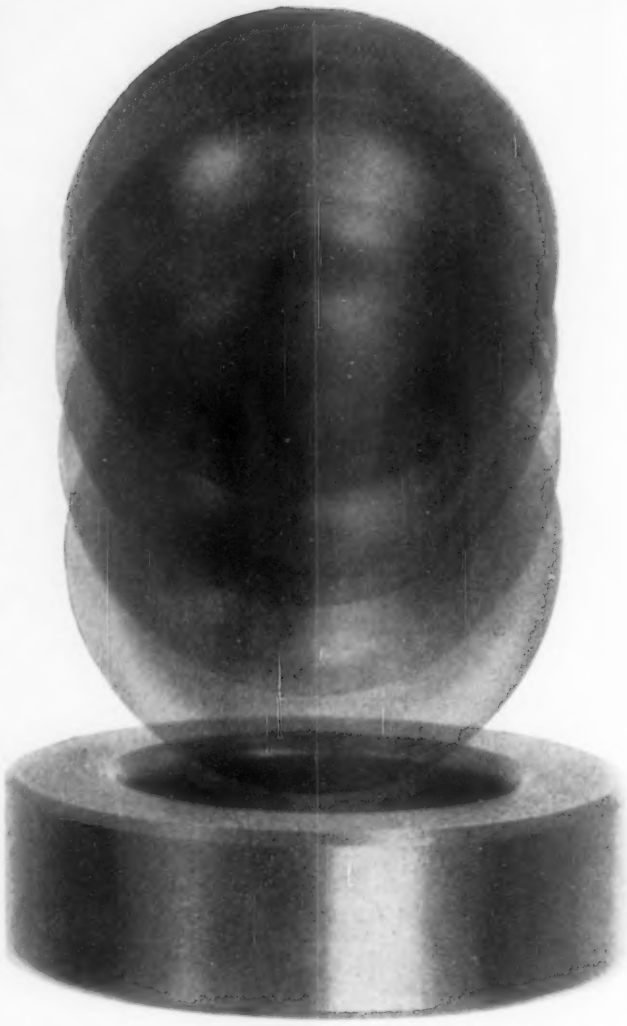
Ball and seat of Kennametal* or Kentanium* stays *down* longer . . . cuts well downtime . . . keeps production high . . . profits *up*.

High hardness . . . extremely high resistance to wear, to corrosion, and to deformation under impact . . . Kennametal Balls and Seats stay on the job from 3 to 5 times longer than "special" or "super" alloys . . . 20 times the service of steel . . . even under the most severe conditions of ball pounding, ball-on-seat impact, sand abrasion, or acid corrosion. More oil is moved up . . . at a faster rate . . . and with fewer pump pulls, less oil well downtime. Pump repair and maintenance costs are cut.

Two grades are available. Kennametal grade KH is for use under high abrasive cutting conditions. Kentanium is recommended for use in applications where severe cage wear, corrosive sand, sulfide fluids, and seat impact are met. Kentanium, being one-third lighter than steel, greatly reduces ball-on-seat shock.

It will pay you to use Kennametal or Kentanium balls and seats to combat wear, impact failure and corrosion in your operations. For further information, contact your regular supplier, or write KENNAMETAL INC., Dept. OG, Latrobe, Pennsylvania.

*Trademarks



Let it pound away!

A Kennametal Ball and Seat provides exceptionally high resistance to:

. . . fluid cutting	. . . ball pounding
. . . wear	. . . ball-on-seat shock
. . . corrosion	. . . electrolytic action

INDUSTRY AND
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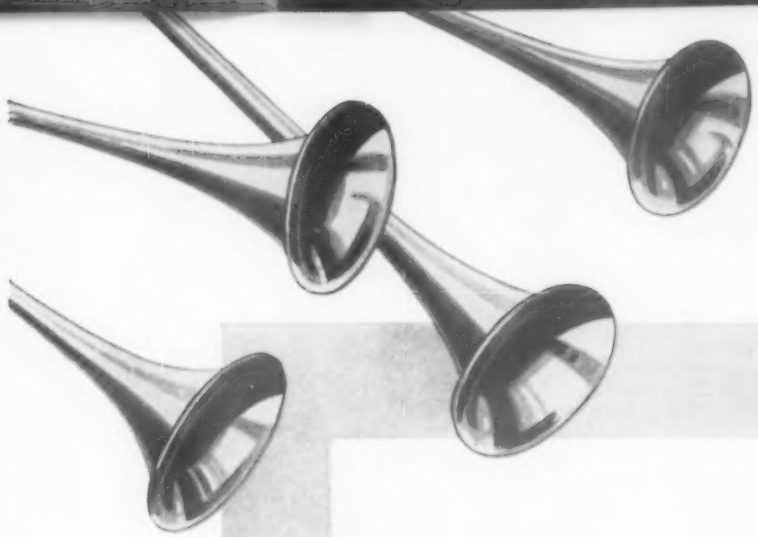
. . . Partners in Progress



—and NOW

Hobbs

To further serve our good friends in the great oil field area of West Texas and New Mexico — Wilson Supply Company has opened its new store at Hobbs — adequately staffed and fully stocked with equipment and supplies for the Drilling and Producing Industry.

"WHAT YOU WANT — WHEN YOU WANT IT"

MAIN OFFICE and WAREHOUSE — 1301 CONTI ST.

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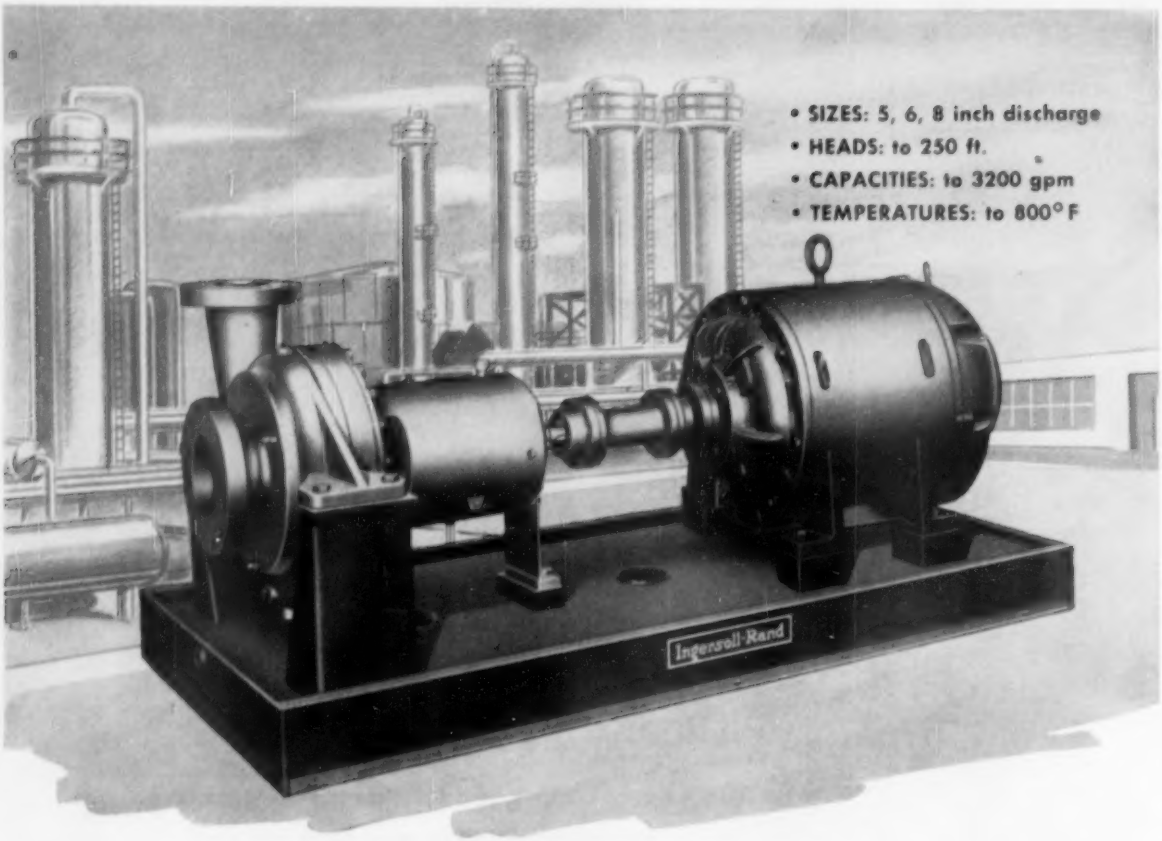
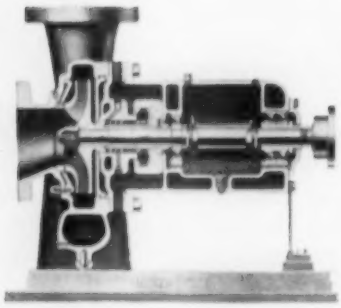
WILSON SUPPLY CO
HOUSTON, TEXAS



BUILT TO DO THE JOB

in large capacity slurry pumping



Ingersoll-Rand closed-impeller Class BSFL slurry pump arranged for injection at the vertical ring fit.

Ask for Bulletin 7094-B

Ingersoll-Rand's vertically-split, Class BSFL, refinery pump shown above has established an enviable record for continuous, dependable performance.

Available in conventional or special slurry pump construction, it is recommended wherever large capacities are required at medium operating heads. Here's the pump you'll find in wide use for bottom circulation or slurry service.

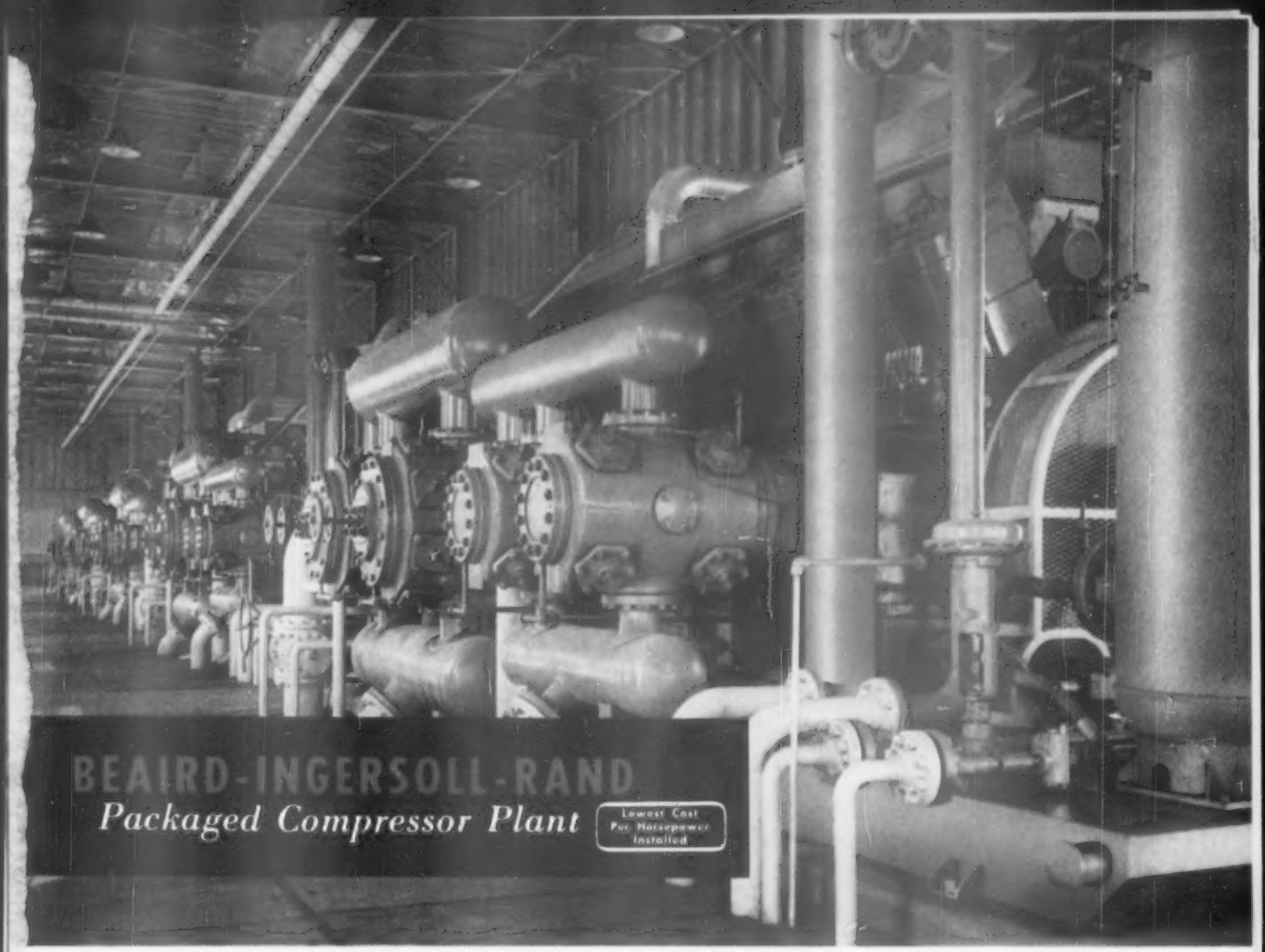
As a slurry pump, the unit can be furnished with either open or closed impeller. Both types have renewable shrouds that protect the casing at front and rear of impeller, and an adjustable thrust bearing journal sleeve to maintain proper clearance with the front shroud or casing ring. A flushing connection to the throat bushing provides for clean oil injection, minimizing packing and sleeve wear.

Let our engineer give you complete details about these and the many other pumps in our complete refinery line.

Ingersoll-Rand IR

10-377 11 BROADWAY, NEW YORK 4, N.Y.

PUMPS • COMPRESSORS • ROCK DRILLS • VACUUM EQUIPMENT • CONDENSERS • AIR AND ELECTRIC TOOLS



NATURAL GAS PIPELINE COMPANY OF AMERICA'S QUINDUNO STATION—equipped with five Beaird-Ingersoll-Rand 12SVG 660 h.p. packaged compressors. Young radiators with lubricating oil coolers, gas interstage and after coolers and all necessary controls. Other sizes 110 to 660 h.p.

Packaged Compressors Handle —

CRITICAL SOUR GAS PRODUCTION PROBLEM

3300 packaged compressor horsepower is used in the Natural Gas Pipeline Company of America's Quinduno Field station to boost sour casinghead gas through a desulphurization plant and into transmission lines. Providing this horsepower are five Beaird-Ingersoll-Rand 12SVG 660-h.p. units. Gas engineered for the job, the units are equipped with stainless steel compressor piston rods and special rings. Engine radiators which contain gas interstage and aftercooling sections, have been constructed with admiralty metal tubes and aluminum fins. All compressor fittings and scrubber elements have been built from non-corrosive materials.

Capable of handling up to 25 mmcfd, the units pick up at 19 psig and use two stages to boost the gas to transmission line pressure of 260 psig.

Packaged compressors were selected by Natural Gas Pipeline because of the savings that could be achieved in installation time and labor. Also should the gas volume drop off, one or more plants could be moved as complete units to other service. The remaining units would then economically continue production throughout the life of the field. Each of the units when finally taken out of this service, and moved to another, will be almost wholly salvaged.

Let us show you how a Beaird-Ingersoll-Rand packaged compressor plant can be designed to meet your special operating requirements.

BEAIRD MACHINING MANUFACTURING STEEL WAREHOUSE

THE J. B. BEAIRD COMPANY, INC.

PACKAGED COMPRESSOR PLANTS

CAST STEEL FITTINGS

PRESSURE BULK STORAGE

ANHYDROUS AMMONIA EQUIPMENT

LP-GAS SYSTEMS

SHREVEPORT, LOUISIANA • Sales Offices: *Dallas, Houston, Corpus Christi and Midland, Texas • New Orleans, Louisiana • Tulsa, Oklahoma • Denver, Colorado • Los Angeles, California, and Cie. Ingersoll-Rand, Paris, France*

CONTROLLED QUALITY

COMPLETE STRESS RELIEVING ON BEAIRD PRESSURE STORAGE TANKS

Engineers will tell you that stress relieving produces safer, more dependable storage vessels by eliminating internal stresses set up during forming, rolling and welding of tank sections. This important safety feature is available from Beaird, Shreveport, where one of the South's largest stress relieving furnaces is in operation.

Capable of handling tanks up to 75,000-gallon capacity, the stress relieving furnace has been installed as part of the tank assembly line. This permits volume production of stress relieved tanks without change or delay in shipping schedules.

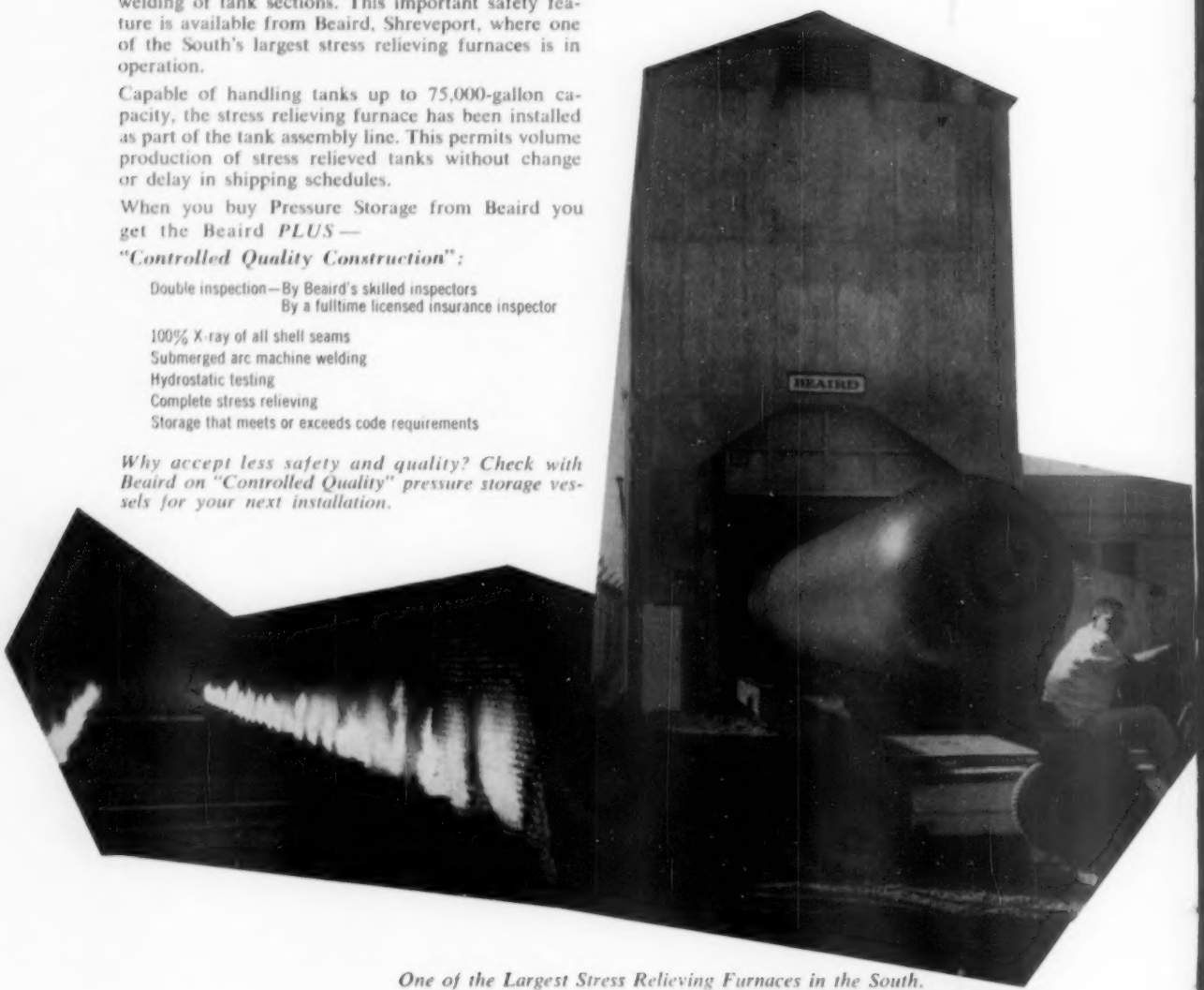
When you buy Pressure Storage from Beaird you get the Beaird *PLUS*—

"Controlled Quality Construction":

Double inspection—By Beaird's skilled inspectors
By a fulltime licensed insurance inspector

100% X-ray of all shell seams
Submerged arc machine welding
Hydrostatic testing
Complete stress relieving
Storage that meets or exceeds code requirements

Why accept less safety and quality? Check with Beaird on "Controlled Quality" pressure storage vessels for your next installation.



One of the Largest Stress Relieving Furnaces in the South.

BEAIRD

THE J. B. BEAIRD COMPANY, INC.

PACKAGED COMPRESSOR PLANTS

CAST STEEL FITTINGS

PRESSURE BULK STORAGE

ANHYDROUS AMMONIA EQUIPMENT

LP-GAS SYSTEMS

MACHINING
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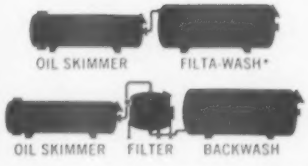
STEEL WAREHOUSE

SHREVEPORT, LOUISIANA • Sales Offices: *Dallas, Houston, Corpus Christi and Midland, Texas* • *New Orleans, Louisiana* • *Tulsa, Oklahoma* • *Denver, Colorado* • *Los Angeles, California* and *Cie. Ingersoll-Rand, Paris, France*

On Waterflood Projects...

BS&B AQUA-Kleener* Systems

Extend The Service Life Of Water Injection Wells!



THESE FOUR AQUA-KLEENER COMPONENTS . . . PROVIDE NEEDED FLEXIBILITY TO HANDLE YOUR FULL REQUIREMENTS OR TO SUPPLEMENT YOUR EXISTING INSTALLATION.

The BS&B AQUA-KLEENER System was especially developed to meet the water conditioning requirements for water-flooding, sub-surface disposal of salt water and off-shore water disposal.

Numerous AQUA-KLEENER installations, similar to the one pictured above, are today greatly extending the service life of water injection wells by removing solids, oil traces and other contaminants before the water is pumped back underground. If this were not done, the underground formation pores would soon become clogged to the point where the injection well would cease to function.

In addition to its primary function of removing solids and oil traces from lease-produced and surface waters, AQUA-KLEENER also performs the valuable secondary functions of reducing precipitation due to oxidation of iron, minimizing corrosion, holding carbon dioxide in solution, retarding aerobic bacteria growth, and in most cases, eliminating the need for chemical treatment of the water.

If you have a water injection or disposal problem, it will pay you to get full details on AQUA-KLEENER Systems from your BS&B Representative. Or you may write to . . .

* AQUA-KLEENER and FILTA-WASH are trade names of Black, Sivalls & Bryson, Inc.

EFFICIENCY OVER 60 YEARS BS&B RELIABILITY
ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

BLACK, SIVALLS & BRYSON, INC.
Oil & Gas Equipment Div., Dept. 1-A11A
P. O. Box 1714
Oklahoma City, Oklahoma

How to cap a climax safely, economically

UNIBOLT
flow manifolds

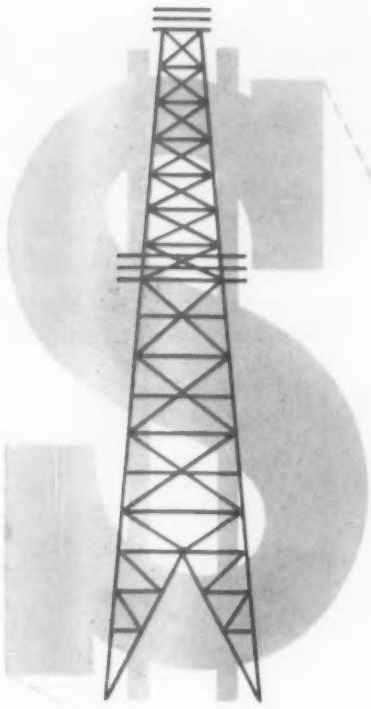
More and more operators are requesting their Christmas tree supplier to furnish UNIBOLT Flow Manifolds because they are lighter in weight, stronger, economical and easier to maintain.

Employing standard UNIBOLT connections rather than flanges, the UNIBOLT Flow Manifold is many pounds lighter, yet the UNIBOLT design, which places more steel in shear, actually results in a higher factor of safety for the manifold.

The three parts of the manifold — UNIBOLT Tee or Cross, Adjustable Wing Valve, and Positive Choke Body — are pressure-tested as a unit and may be assembled in a number of combinations to best meet individual needs. They are furnished in regular forged steel or in high-chrome alloy for corrosive wells — 6,000, 10,000 and 15,000 lbs. test.

The manifold is completely salvageable, either as an assembly or as individual units. Since all of its connections are standard UNIBOLT design, each unit freely interchanges with any other UNIBOLT product of the same size and rating.

THORNHILL CRAVER CO.
P. O. BOX 1184 HOUSTON, TEXAS



Bankers to the OIL INDUSTRY

NATIONAL BANK OF TULSA
NBT

As Oklahoma approaches its Golden Anniversary, pioneers in the oil business credit the experience, financial resources, "know how" and cooperation of officers of "The Oil Bank of America" with their progress and success through the years in the great Southwest and Midwest territory.

Yes, the Oil Department of National Bank of Tulsa has helped many independent operators, companies, contractors and suppliers in financing their exploration, drilling, production, pipe line, refining and marketing programs. The Oil Department of NBT will welcome the opportunity to discuss your financial needs.

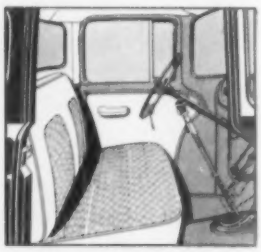
MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

NATIONAL BANK OF TULSA

The Oil Bank of America

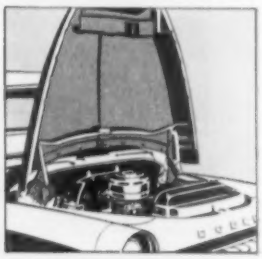
OFFERING COMPLETE BANKING AND TRUST SERVICES

FIRST NEW



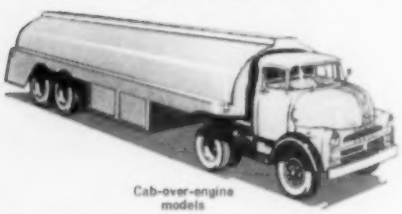
NEW COMFORT CABS

Industry's largest, for real stretch-out comfort. All-new seat design permits adjustment of back cushion and seat height, plus normal slide positioning.



FULL-OPENING HOOD

Exclusive!—Can be raised full 90° for easiest, fastest engine servicing, half-way for routine oil and water checks.



Cab-over-engine models

SHOWING

DODGE

PowerGiants

- **NEW giant-power V-8 engines!**
- **NEW push-button driving!**
- **NEW higher load capacities!**
- **NEW *Forward* Look styling!**

Get set to profit from a great *new* kind of truck—with *more* V-8 power and *more* payload capacity—with *more* eager-to-go snap than any other make on the road!

From 204-hp. pick-ups to 232-hp. tandems, today's new low-priced V-8 Dodge *Power Giants* deliver more truck per dollar—and more profitable payloads—in *every* weight class, 4,250 lbs. G.V.W. to 65,000 lbs. G.C.W.

New short-stroke Chrysler-engineered V-8's—with exclusive Power-Dome combustion—give you more miles per gallon, full power on *regular* gas. Increased power in famous, dependable Dodge 6's, too.

Push-button automatic transmission is still another great plus you get only in new Dodge *Power Giants.** First in any truck! Simple, sure, trouble-free. Just push a button, shifting is automatic.

Test-drive a Power Giant—V-8 or 6—soon! Get your Dodge dealer's deal *before* you decide on your new truck.

**Available on low-tonnage and forward-control models.*

DODGE TRUCKS

WITH THE *FORWARD* LOOK

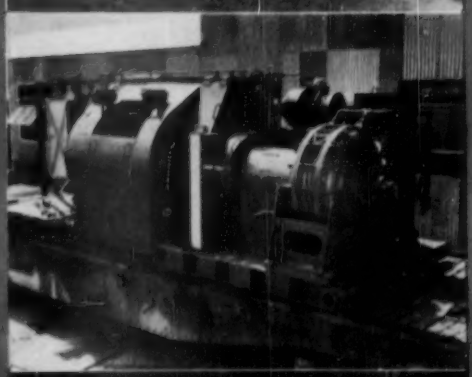
4 pick-up models, up to 8,800 lbs. G.V.W

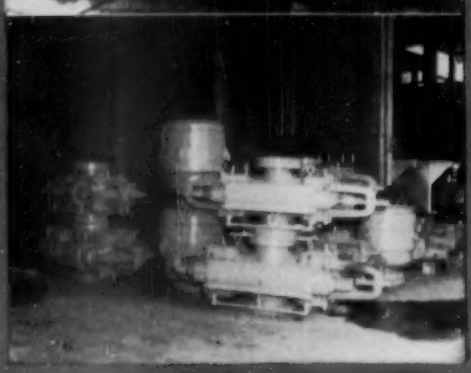
Door-to-door delivery chassis

Tractor models up to 65,000 lbs. G.C.W.

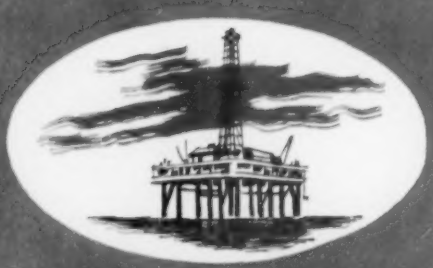
Cab and chassis models

what AVONDALE'S O.T.* means to the Oil Man





AVONDALE'S OIL TOOLS DEPARTMENT is a complete, efficient and powerful force to turn your repair problems into pleasant routine. The best possible equipment is provided for your needs and workmanship is expert in the fullest sense. For large or small repair jobs—hydramatic brakes, crown & traveling blocks, blow-out preventers and control manifolds, drawworks, swivels, dragline buckets and a wide diversification of other oil machinery jobs—the Oil Tools Department is your best source of satisfaction. Call Avondale today . . .



A new and complete Oil Tools Machine Shop has just been opened at Avondale's Harvey Plant.

SHIP BUILDING · SHIP REPAIRING · FOUNDERS · PROPELLERS · STRUCTURAL STEEL

AVONDALE MARINE WAYS, INC.

CABLE ADDRESS "AVONWAYS"

P. O. BOX 1030 • PHONE UNiversity 6-4561 • NEW ORLEANS 8, U. S. A.

WHAT'S NEW AT BRISTOL...

RIDING 250-MILE PIPELINE from his desk at Charlotte, N. C., Piedmont's gas dispatcher makes instant decisions with aid of this battery of 1- and 2-pen Bristol recorders. They show pressure, temperature and flow at 46 remote points.

Takes 46 readings over 250-mile pipeline with only 4 wire circuits

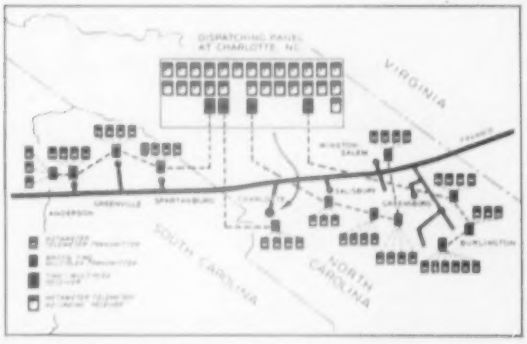
Piedmont Natural Gas Company is first to use new Bristol Intermediate Time-Multiplexing system

With the new Intermediate Time-Multiplexing system, only four leased wire circuits are needed to send readings from 46 telemeter transmitters along Piedmont's 250-mile pipeline to a central dispatching headquarters at Charlotte, N. C.

The close continuous supervision provided by the new Bristol instrumentation system enables operation of Piedmont's complex gas distribution facilities at nearly 99% load factor.

Multiplexed Bristol Metameter Telemeters provide transmission of up to 15 instrument readings over a single wire circuit. With the new Intermediate Time-Multiplexing, these readings may be multiplexed onto the line at *widely separated intermediate stations*—effecting great economies in the number of required circuits.

Find out how these Bristol Metameter Telemeters can solve *your* complex telemetering problem in the most economical manner. Write The Bristol Company, 120 Bristol Road, Waterbury, Conn. 545



TWO-STATE COVERAGE with only four leased telephone circuits is effected by this instrumentation system. Note that as many as four intermediate time-multiplex transmitters add readings to a single circuit at different points.

BRISTOL *POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION*

BRISTOL'S

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

OLIVER

OC-3 "Little Boomer"

...for big savings on all those smaller jobs

There's a heap of cost-cutting ability wrapped up in this compact, lightweight pipeliner's package. In a total weight of only 5205 lb., the OC-3 "Little Boomer" has the size and weight advantages for faster handling of light pipelining work and *all* those important allied jobs—grading, backfilling, winching, bending and even ditch bottom cleanups.

The OC-3 fills the gap perfectly, giving you speedy crawler handling to end costly hand labor at many points on the spread...and ample capacity to do all those jobs that otherwise would divert larger machines from more profitable work.

The OC-3 is big in capacity considering its handy small size...lifts up to 2000 lb. ...totes up to 40′ of 12″ pipe...lays and lowers pipe of 6″ diameter. It's a snap to move from job to job quickly on light truck or trailer.

Just two controls with hydraulic boom and line make spotting pipe fast, effortless, accurate. And the OC-3's two-track power at all times, even on turns, gives you the safety and get-through traction to further add to profits.

For very little investment, see how the OC-3 can repay some handsome big dividends. See your Oliver distributor or write for the new Bulletin A-1042.

"BOOMERS"

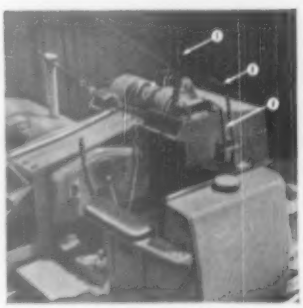
OC-12 with new all-hydraulic boom
...watch this 2-control rig increase work and safety

The Oliver OC-12 is simplified all the way! Just two controls make any operator an expert right off the bat—with these immediate benefits for you: faster, safer operation...lower pipelaying costs all the time.

The husky, responsive 12′ side boom is all-hydraulic...provides safe, smooth lifts up to 13,375 lb. without any danger *ever* of clutch failures.

Now brand-new on the OC-12 is Oliver's Power-Turn which keeps power on both tracks at all times—to speed job approaches, increase maneuverability. Also new is over-center hand clutch 33⅓% larger than before...and new foot brake to free operator's hands for working boom controls without interference.

It will pay you to get all the facts on the new 53 h.p. OC-12 Pipeliner's Special. Try it at your Oliver distributor's or write for literature.



Simple as 1-2-3. Here's the operator's easy control of the all-hydraulic side boom. 1. load clutch... 2. load line control...3. boom line control.

THE OLIVER CORPORATION
400 West Madison Street, Chicago 6, Illinois

OLIVER

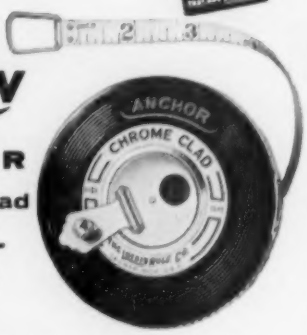
A COMPLETE LINE OF INDUSTRIAL WHEEL AND CRAWLER TRACTORS AND MATCHED ALLIED EQUIPMENT

CORROSION RESISTANT LINE
GLARE FREE MARKINGS
TOUGH LEATHER CASE

EASY TO READ MARKINGS THAT ARE DURABLE

LUFKIN

ANCHOR
Chrome Clad
STEEL
TAPE



Bold black markings contrast with exclusive "glare-free" Chrome Clad surface on Lufkin "ANCHOR" Steel Tapes. Multiple coats of electroplate add strength and protection. Wipes clean and is tarnish-proof. Handsome, genuine leather case, hand stitched, with rust-resisting metal liner. Replaceable lines in 25 to 100 foot lengths.

BETTER MEASURE WITH LUFKIN

BUY LUFKIN TAPES • RULES • PRECISION TOOLS FROM YOUR SUPPLY HOUSE

THE LUFKIN RULE COMPANY • Saginaw, Mich.
New York City • Barrie, Ontario

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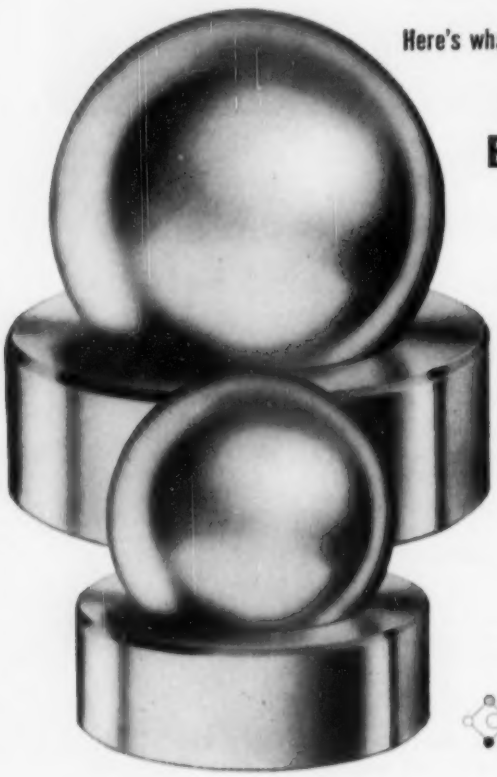


Here's what you get with

KENNAMETAL* BALLS and SEATS

EXCEPTIONALLY HIGH RESISTANCE TO

- Fluid Cutting
- Wear • Corrosion
- Electrolytic Action
- Ball Pounding
- Ball-on-Seat Shock

If you have a problem well, or just want longer life, less pump downtime, ask your pump service man to install Kennametal API Balls and Seats. They will cost you less in the long run. KENNAMETAL INC., Latrobe, Penna.

*Registered Trademark

INDUSTRY AND KENNAMETAL ...Partners in Progress

They Say—

Tanker Expansion Doubts

"Two items of news have focused attention again on the future demand for oil tankers. In Washington President Eisenhower has ordered plans to be drafted for the possible construction of a new oil-tanker fleet in case of emergency; and in Tokyo a group of three Japanese oil companies have announced tentative plans to build a number of big tankers for the exclusive use of Persian oil.

"The Suez crisis has naturally led to a fresh appraisal of the number of tankers likely to be needed in the future. But it was already being assumed in the oil trade and elsewhere that a further expansion in tanker building would be necessary if the current estimates of future world oil consumption proved to be near the mark.

"In the face of this expansion of demand, the current orders for tankers do not seem large. Indeed, it is suggested that, excluding tankers which will be over 20 years old by 1960, the world-tanker fleet will grow by only 28 per cent as a result of present contracts. Whether that expansion will prove large enough remains to be seen, but it is interesting that doubts are beginning to grow, whatever the outcome of the Suez dispute."

Editorial in the London Times

Future's Toughest Tasks

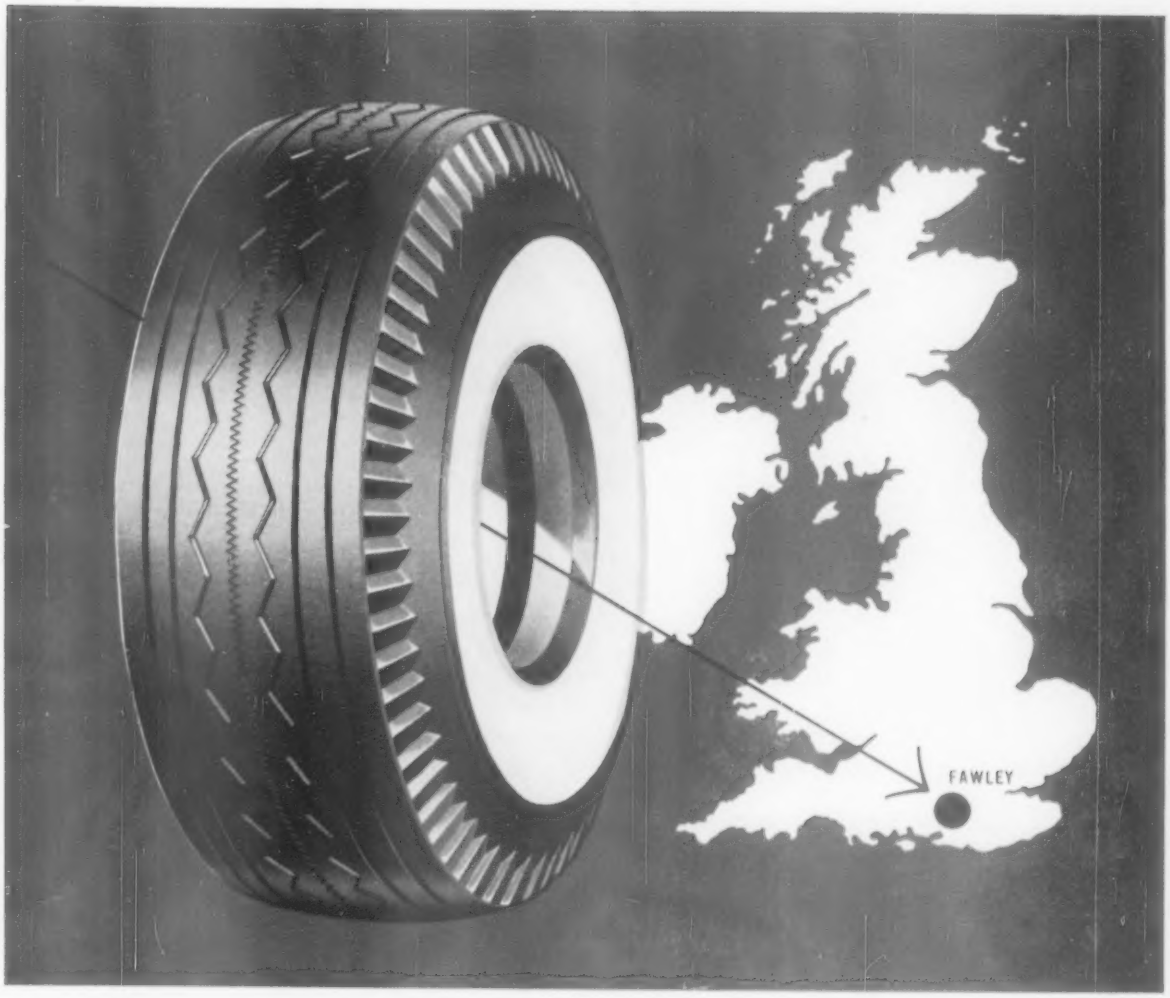
"Men have discovered the key to productivity. That key is the managerial and technical ability to release and harness the gigantic force of natural energy. It is a key which has opened the door to standards of living undreamed of by our forefathers.

"Progress from where we now are —and the rate of that progress—will depend upon our ability to multiply this productivity—to apply this key on a world scale. The technical problems to be overcome can be solved. The most difficult problems are political, economic, and social."

Eugene Holman, chairman of the board, Standard Oil Co. (N. J.), in a speech before the American Bankers Association, Los Angeles.

A Broken Import Precedent

"The elimination of District 5 (West Coast) from any quota on imports is without precedent in this country. If the West Coast is incapable of producing its needs, then we should look



another Blaw-Knox ***FIRST*** *in the Rubber-Resins-Plastics field*

The contract recently awarded Blaw-Knox Company by The International Synthetic Rubber Company, Ltd.,* will be another significant achievement for Blaw-Knox . . . design and construction of the first synthetic rubber plant in Great Britain, at Fawley, England.

This and scores of other rubber, resins and plastics projects . . . both large and small . . . have provided Blaw-Knox the technical skill and practical experience needed to best handle *your* next project . . . from preliminary planning through initial operation and training of personnel. We'd like to discuss *your* plans . . . for a single unit or a complete plant.

Over the years, Blaw-Knox Company has made many important contributions to this industry. For example:

1936 First Dowtherm-heated and cooled Alkyd-Resin Kettle . . . for Devoe & Raynolds Company

1941 First plants to produce GR-S Rubber in the United States . . . for Firestone Tire & Rubber Co. and U. S. Rubber Co.

1951 First Radiant Heated Resin Kettle . . . for Pratt & Lambert, Inc.

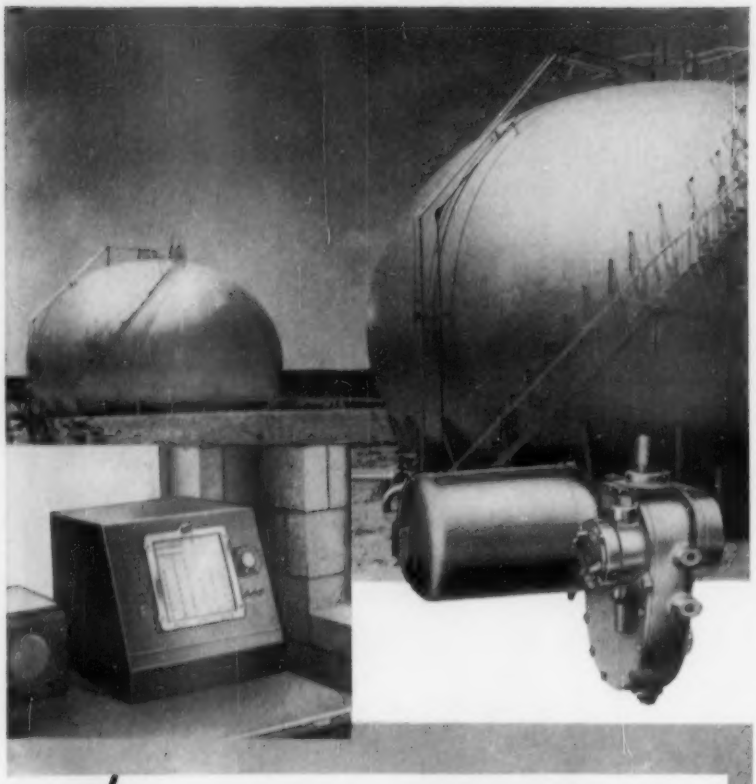
*Principal shareholders are: Dunlop Rubber Company, Ltd.; The Goodyear Tyre & Rubber Co. (Great Britain), Ltd.; The Firestone Tyre & Rubber Co.; Michelin Tyre Co., Ltd.

50th Anniversary BLAW-KNOX 1906 1956

BLAW-KNOX COMPANY • Chemical Plants Division

Pittsburgh 30, Pennsylvania • Chicago 1, Illinois

Birmingham, New York, Philadelphia, San Francisco, Washington, D. C.



"Varec" PULSE CODE KEEPS "TAB" ON OKAN PIPELINE

Keeping a pipeline flowing smoothly is a mighty big job . . . that's why OKAN PIPELINE wants the latest in automatic equipment to speed its work. An important part of this equipment is the "Varec" PULSE CODE Telemetering System, which signals the liquid level of storage tanks at terminals and along the line. In addition to this function, it turns valves on and off by remote control.

"Varec" PULSE CODE operates over long distances, giving an accurate signal. It requires only a simple metallic pair for a communication link. It supplies a fast reading in the record time of 5 seconds. There is also a unique feature for remote control of valves, pumps, etc., which confirms that the proper selection of remote function has been made and indicates the status of the selected function. The operator may now change the status and receive a confirmation that it has been completed.

You may want to cut your operating costs by using a "Varec" PULSE CODE System. Equipment for reporting either spot or average temperature, in addition to liquid level, is now available.

Write for "Varec" Bulletin CP-3011 for full details on "Varec" PULSE CODE Telemetering.

961-17

THE VAPOR RECOVERY SYSTEMS COMPANY

"Varec"

Compton, California, U. S. A.

Cable Address: Varec Compton Calif (U.S.A.) All Codes

to the balance of the domestic industry to supply that need. It is, of course, true that District 5 does not produce all the crude petroleum it consumes. However, New Jersey does not raise enough beef to supply themselves, but we don't allow them to import at will.

"An order such as this denies the producers of this country the right to serve that market. It precludes the building of a pipeline from the Mid-Continent area to the West Coast as it would be impossible to compete with an unlimited supply of cheap foreign crude."

Mack M. Braly, Oklahoma Independent Petroleum Association, statement before the Office of Defense Mobilization hearing on imports.

Imports or Offshore?

"There are vast potential and unexplored oil provinces within the United States including the offshore areas. The basic issue is whether this country will choose, as a matter of national policy, to rely on foreign oil to an increasing extent from such uncertain sources as the Middle East . . . Let there be no mistake about it, the offshore oil reserves of this country cannot be developed in unrestricted competition with surplus oil from the Middle East."

J. P. Coleman, director of the Independent Petroleum Association of America, before the Office of Defense Mobilization hearing on imports.

Needed: 100 Fields Each Year

"Public demand for petroleum products today uses up an amazing total of about 100 average-sized oil fields every year, which means that in order to stay up with demand the oil industry must find at least 100 new oil fields every year."

S. F. Bowlby, vice president, Shell Oil Co., in a speech before the Tucson Oil Information Committee.

The Important Right to Risk

"In the United States anyone has a right to go out and risk his dollars . . . hundreds, thousands, or millions . . . in oil drilling ventures knowing in advance that oil in profitable quantities is found in only one well out of 42 exploratory wells drilled. Government monopolies shy away from such unfavorable odds, but private industry takes them in its stride . . .

"There is no doubt in my mind that the American oil industry owes its vast growth to the freedom from unreasonable governmental control implicit in our system of democratic capitalism and free enterprise.

"Business firms today face a series of intangible but very real challenges

IS PARAFFIN SQUEEZING YOUR PROFITS?

INSIST ON SOUTHWESTERN PLASTIC PIPE

With today's rising production costs . . . can you afford to let paraffin build-up cut your profits. Southwestern Tenite Butyrate Plastic Pipe has been installed in many troublesome paraffin areas and has helped solve the paraffin build-up problem.

The metal pipe shown in this illustration is typical of lines that become plugged in from three to six months. Southwestern Tenite Butyrate Plastic lines in the same areas have remained trouble-free for almost two years.

Can you afford to use any pipe but Southwestern? Get the facts. Mail the coupon today.

- WILL NOT CORRODE
- REDUCED PARAFFIN BUILD-UP
- LIGHTWEIGHT
- ECONOMICAL INSTALLATION

SOUTHWESTERN PLASTIC PIPE CO.

P. O. Box 117 • Mineral Wells, Texas • Phone 2050

KRALASTIC PIPE
TENITE BUTYRATE PIPE
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POLYETHYLENE PIPE
CHEM-WELD PIPE

SOUTHWESTERN PLASTIC PIPE

We are interested in Plastic Pipe for use in _____

In this application, temperature will be about _____

with pressures of _____

☐ Have Someone call on us ☐ Send Free Literature

Please Print Or Write Plainly

Company _____

By _____

Mail Address _____

Town _____

NEW,
LARGE-CAPACITY
AER-O-FOAM
PW-50 NOZZLE
NATIONAL FOAM
SYSTEM, Inc.
West Chester, Pa.
The only company exclusively engaged in the design, development and manufacture of foam fire protection equipment and chemicals.
200 FT.
Delivering as much as 4600 GPM of fire-fighting foam, the new Aer-O-Foam PW-50 Nozzle brings new dimensions to effective Aer-O-Foam fire-fighting techniques. This multi-purpose nozzle extinguishes fires on the ground, in sludge or settling pits and in ponds, and in large dike areas. It may be mounted on foam trucks, fire boats or crash trucks, or may be used with fixed piping near process units in refineries and chemical plants.
The PW-50 can be shifted quickly from straight stream to spray stream operating and vice versa. It operates on both foam solution and water alone. Range of straight foam stream extends to 200 feet at top pressure; spray stream operation produces an effective foam spray pattern up to 88 feet in length.
For better control of fire in flammable liquids, you'll want full information on this new nozzle. Write today.

to their right to operate as private enterprises.

"In the petroleum industry, an attempt was made to pass a law in Michigan that would have made gasoline retailing a public utility . . . because of the allegation that prices were too high. In the meantime, Congress was considering a bill that would have kept oil companies from lowering prices to meet competition. How is it possible to charge too much and too little at the same time?

"In the natural-gas part of our industry, a Supreme Court decision empowered the Federal Power Commission to regulate the price of gas produced by independent gas producers. The idea, they say, is to keep gas prices low for the benefit of the public. Yet, this gas price control means that these producers cannot acquire the capital necessary to explore for more gas, so unless corrective legislation is passed, the public will inevitably have to put up with a gas supply that is too little, too late, and too expensive."

David T. Staples, president, Tidewater Oil Co., in a speech before the Portland, Ore., Chamber of Commerce.

Canadian Import Problem

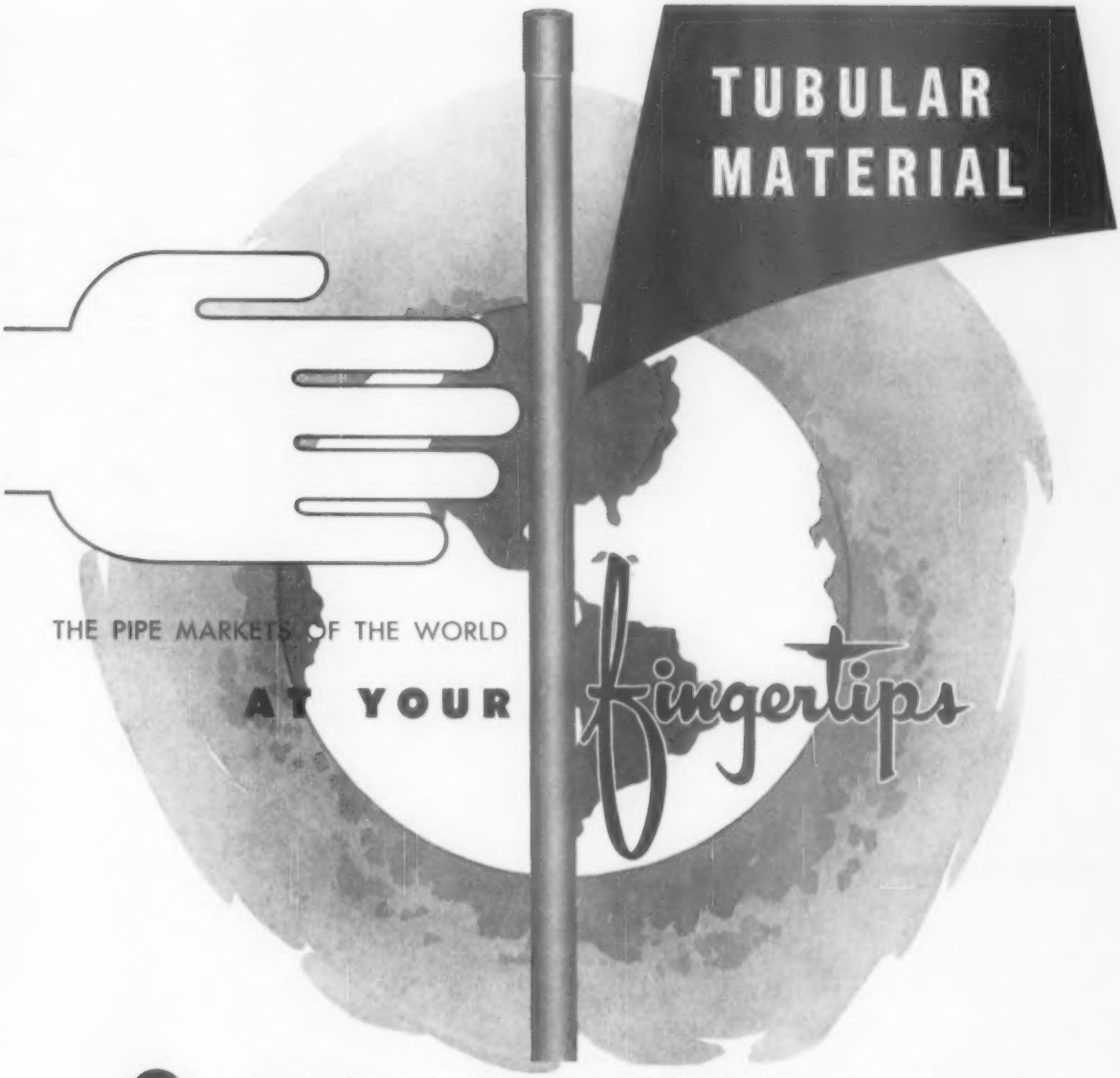
"Mutual defense plans clearly justify differential treatment for imports from Canada, but this does not mean that it is either necessary or desirable to exclude these imports from the basic policy of limiting total imports within the 1954 ratio to U.S. production. Neither national security, nor the joint security of the United States and Canada, is strengthened by importing Canadian oil at the expense of domestic production."

W. M. Vaughey, chairman of executive committee, Independent Petroleum Association of America, before hearings of the Office of Defense Mobilization on imports.

Big Business Achievements

"In finding the money necessary for capital investments, we face . . . serious situations. The first is the antagonism of segments of the American people to Big Business. This antagonism is not justified by the record of performance of Big Business, which has developed the mass production technique we use to supply our people with what they want, which has spread the benefits of production to most of our people as customers and earners, which is responsible in large part for the establishment of security and dignity in their work for great numbers of people.

"Nevertheless, this antagonism exists and results in political harrassment of business men, discriminatory laws, restrictions on freedom of action, con-



Having pioneered in the distribution of the oil industry tubular products of many mills of Europe and Asia, Lucey Products Corporation was a key in the organizing and planning necessary to prepare them for production of pipe of complete interchangeability . . . strict conformance with API standards of specifications and quality . . . universal acceptance.

Long and successful experience in this field recommends Lucey Products Corporation for tubular requirements when circumstances suggest sources other than the United States.

For normal home requirements we are distributors for C. F. & I., Lone Star, Pittsburgh and Wheeling.

PRODUCTS LUCEY CORPORATION

LUCEY PRODUCTS CORPORATION

TULSA, OKLAHOMA

OKLAHOMA CITY • DALLAS • HOUSTON • ODESSA • SHREVEPORT • LOS ANGELES • CALGARY

See Joe Roughneck at the API — Room 544A Conrad Hilton Hotel

"thinks a 'round trip' means traveling"

The oil industry continues to go places at a faster and faster pace . . . and, in turn, Lone Star Steel has announced extensive plans to make more and more pipe.

API casing, tubing and line pipe, from Lone Star, is standard of the industry in the great mid-continent oil area . . . where Joe Roughneck is busy day and night . . . drilling for oil to supply the ever-increasing demand.

Lone Star's recently announced plans for another open hearth furnace and more pipe mill facilities have one objective . . . to serve Joe Roughneck better and faster.

Neighbor, wherever you are, specify Lone Star and we both get a good deal!

Lone Star STEEL COMPANY

LSS

EXECUTIVE-SALES OFFICES
W. Mockingbird Lane at Roper • P. O. Box 12226 • Dallas, Texas

DISTRICT SALES OFFICES
Houston, Texas | Midland, Texas | San Antonio, Texas
Tulsa, Oklahoma | Wichita Falls, Texas | Shreveport, La.

stant interference in conduct of affairs.

"I am not pleading for any special favors for Big Business, nor claiming any special virtues for men in Big Business . . . Nor would I have you think that I believe Big Business will absorb all economic activity, or even most of it.

"My only points are that there are certain things which only Big Business can do, because of the concentration of capital investment required by the particular job, and that the problems of the future . . . are going to be solved by even larger Big Business."

Robert L. Minckler, president, General Petroleum Corp., in a speech before the Seattle Chamber of Commerce.

D-X Sunray Takes Imports Stand

"Substantial amounts of foreign oil are definitely needed (in the U. S. today) . . . But, we should not permit our oil imports to reach such a level that if these imports were suddenly cut off our peacetime economy would suffer or that we would find ourselves without sufficient oil to supply our needs in time of war.

"Cheap oil from abroad, if allowed to enter the United States unchecked, could eventually stifle our own search for new reserves, because no oil company can continually spend millions of dollars to find $3-a-barrel oil if it has to compete with $2-a-barrel oil from abroad. It just isn't good business.

"It takes time to find these oil reserves. Congress can declare war but it can't declare new oil reserves."

R. W. McDowell, president, D-X Sunray Oil Co., in a speech before the Kansas City Oil Men's Club.

Texas U's Total Oil Money

Dear Sir:

For the record, regarding the announcement of the November 27 sale of oil and gas leases on University land, on page 91 of your Journal for October 15, 1956, the $259,872,602 said to have been collected from such lease auctions is high for the proceeds of these auction sales. The total received by the University to date for lease sales is $146,610,539.16.

The total used in your story evidently was the total of the Permanent University Fund at a certain recent date, which fund includes both the bonuses received for the lease sales, and the royalties and rentals which have accrued from the operation of the leases.

W. R. Cavett
Auditor, Oil and Gas Production
University of Texas.

EVERY FIELD

OF ENDEAVOR

HAS PRODUCED

ONE

TOP PERFORMER

The greatest

football player

of all time—

"Red" Grange

EVERY FIELD OF ENDEAVOR

HAS PRODUCED

ONE

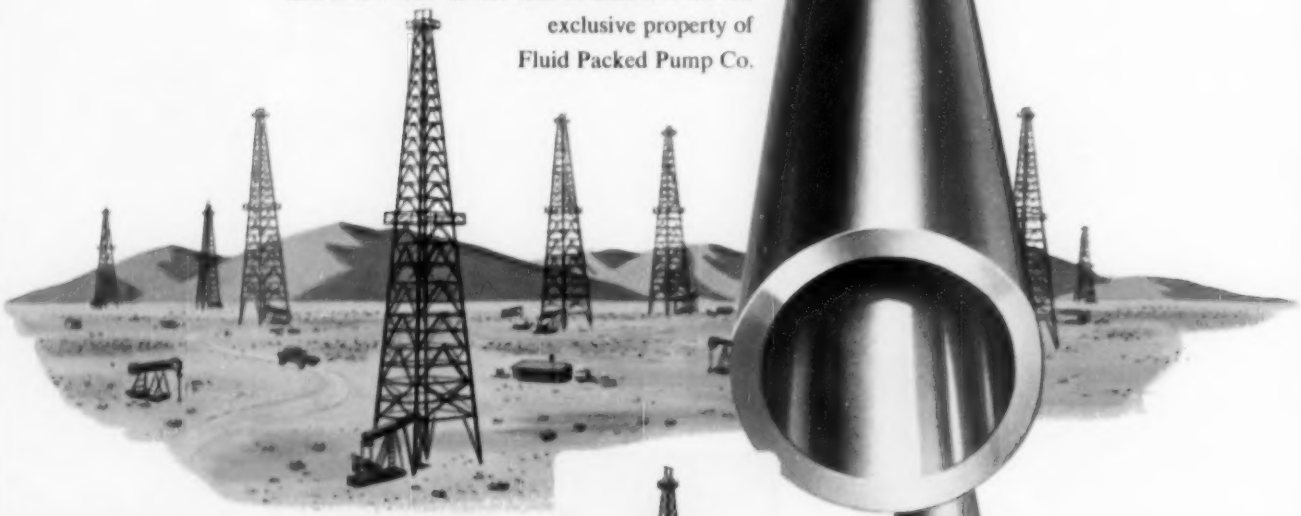
TOP PERFORMER

In football it was "Red" Grange—
For smooth, free plunger operation
under all kinds of pumping conditions it is

oilmaster

HARDENED AND HONED
ONE PIECE PUMP BARRELS

Their design and general construction can, has and will be copied, but thirty years of EXPERIENCE and KNOW-HOW in this field of endeavor are the exclusive property of Fluid Packed Pump Co.



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NOVEMBER

13-14 University of California, National Association of Corrosion Engineers, short course on underground corrosion, Lafayette Hotel, Long Beach, Calif.

15-16 National Association of Corrosion Engineers, Western regional division conference, Lafayette Hotel, Long Beach, Calif.

19-20 American Institute of Mining, Metallurgical & Petroleum Engineers, North Texas Secondary Recovery Symposium, Municipal Auditorium, Wichita Falls.

25-27 Kansas Independent Oil and Gas Association, nineteenth annual meeting, Broadview Hotel, Wichita.

25-30 American Society of Mechanical Engineers, Statler Hotel, New York.

26-28 Conference on Solvent Extraction, sponsored by Oklahoma A.&M. College, Stillwater, Okla.

26-30 National Exposition of Power and Mechanical Engineering, sponsored by American Society of Mechanical Engineers, Coliseum, New York.

27-30 American Chemical Society, National Chemical Exposition, Cleveland.

30 Natural Gasoline Association of America, Panhandle-Plains regional meeting, Herring Hotel, Amarillo, Tex.

DECEMBER

3-4 New Mexico Oil and Gas Association, annual meeting, Alvarado Hotel, Albuquerque.

3-5 Air Pollution Control Association, national semiannual technical meeting, Rice Hotel, Houston.

6-8 American Petroleum Institute, Oil Industry Information Committee meeting, Biltmore Hotel, New York.

6-8 Interstate Oil Compact Commission, annual meeting, Fontainebleau Hotel, Miami Beach, Fla.

9-12 American Institute of Chemical Engineers, annual meeting, Statler Hotel, Boston.

11-12 Water Quality Control for Subsurface Injection, conference sponsored by the University of Oklahoma, Norman, Okla.

1957

JANUARY

14-16 Pipe Line Contractors Association, ninth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

14-18 Society of Automotive Engineers, annual meeting, Sheraton-Cadillac and Statler hotels, Detroit.

17-18 Engineers Joint Council, Statler Hotel, New York.

21-25 American Institute of Electrical Engineers, 1957 winter general meeting, Hotel Statler, New York City.

FEBRUARY

8-9 American Society for Testing Materials, Symposium on composition of petroleum, Jung Hotel, New Orleans.

13-15 National Association of Corrosion Engineers, Tulsa section, eighth annual short course for pipeliners, Hotel Mayo, Tulsa.

22 Natural Gasoline Association of America, Permian basin regional meeting, Scharbauer Hotel, Midland, Tex.

23-25 Instrumentation for the Process Industries, sponsored by Texas A. & M. College, chemical engineering department, College Station, Tex.

24-28 American Institute of Mining, Metallurgical and Petroleum Engineers, annual meeting, Hotels Roosevelt and Jung, New Orleans.

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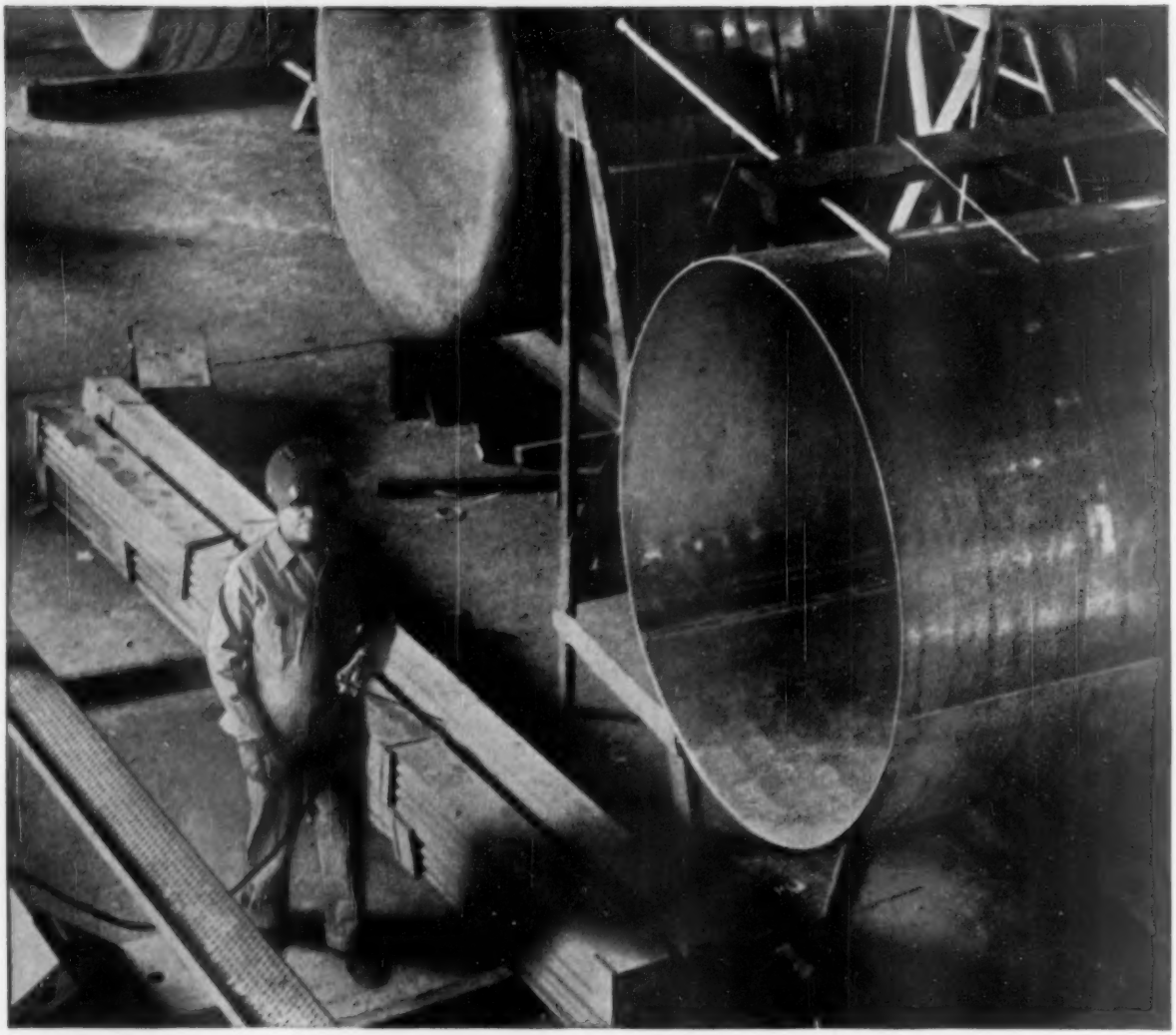

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JOURNALLY SPEAKING . . .

When Oil Was a Gamble

WORD comes from Oil City, Pa., that the old Oil Exchange Building is being torn down to make way for a parking lot.

That won't mean a thing to today's generation of oil men, and probably nothing to their fathers. But there was a time, back in the 1870's and '80's, when the Oil Exchange of Oil City virtually set the price of crude oil for the entire world. Only "set" isn't the right word, because the price of crude fluctuated violently from day to day and even from hour to hour.

It's hard for today's oil operator to realize how oil was marketed in those days, and how uncertain a producer's financial condition was. Nowadays crude purchasers post field prices and find a market at some refinery.

But this system didn't get started until about the turn of the century. In the years immediately following the Civil War, when the oil business was getting established around Oil City and Titusville, Pa., oil brokers visited the wells on horseback and made whatever bargains they could with individual producers. They obtained "certificates," each good for 1,000 bbl. of oil, and these they peddled to refiners or other traders at whatever prices they could get—usually much more than they had paid the producers.

The first oil exchange probably was a railroad coach on the line that was built from Oil City to Titusville in 1866. A special car was fitted up for the oil brokers, and the train took 3 hours to make the 17-mile trip every day because it stopped at every lease so the brokers could dicker with producers. Then they traded the certificates with each other on the way back to Oil City.

Along about 1870 a "curbstone exchange" grew up in Oil City. Brokers had their offices in their hats, and when they met on the corner they would buy and sell oil certificates.

In 1874 an Oil Exchange was formally organized, and established strict rules and hours for trading. Reflecting the size and profitableness of the business, the exchange built an elaborate three-story building in downtown Oil City, containing not only a trading pit surrounded by a big gallery, but offices, committee rooms, reading rooms, telegraph lines, and other conveniences for its 400 members.

For the next 20 years or so the Oil City exchange dominated the crude-oil market of the world. There were other oil exchanges in New York City and elsewhere, and oil production had spread to many places in the Allegheny and Ohio Valley regions. But Oil City was considered the nerve center of the industry, and its oil exchange did far more business than any other.

Because the trading was in paper, not in oil, the number of "barrels" bought and sold in Oil City's exchange each day far exceeded the amount of oil actually in production or in storage. Most of the buyers had no use for a drop of oil, and traded in certificates as a means of speculation. Gambling would be a better term, for prices changed violently on every rumor from the oil fields. News of a new gusher set the price tumbling, while word that a new wildcat was dry, or that a good well had gone to water, sent it skyrocketing. Speculators made and lost fortunes in a few hours.

In 2 days in May 1884, for example, the price of oil on the exchange dropped from 91¼ cents to 77½ cents per barrel, and on each of those days the Oil City exchange sold more than 27,000,000 "barrels."

The beginning of the end came in 1895 when Joseph Seep, crude-oil buyer for the old Standard Oil Co., announced that thereafter he would buy crude at the highest price justified by world markets, without regard to quotations for oil certificates. This brought some stability to the price and eliminated the need for brokers. Gradually the oil exchanges went out of business.

As oil production moved into the Southwest and the Mid-Continent, some oil exchanges flourished for a time in flush areas. But as soon as pipelines were built and field prices were posted, oil was bought as a commodity for use, not as certificates for speculation.

Maybe you think the oil business is still a gamble. But today the gamble is chiefly with the vagaries of Mother Nature. There's nothing like the gambling that took place when the price of crude was determined by a bunch of speculators trading in paper certificates back in the "good old days."

—*Henry D. Ralph.*

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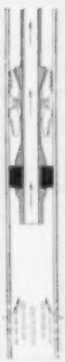

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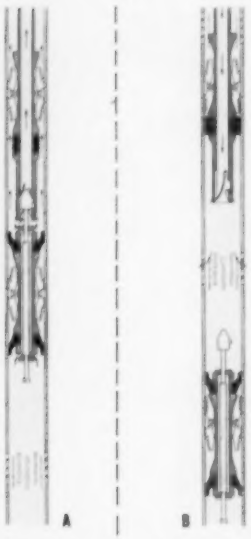

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C

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D

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What oil can expect the next four years

NOW that the 1956 election is history, the oil and gas industry can plan ahead with more confidence. But it should not lightly assume that the election means simply "four more years of the same."

Because oil and gas did not become an issue in the national campaign, the industry is in a neutral political position. It can hold up its head and say its say, with nothing to be ashamed of nor afraid of. It should get a receptive ear in Washington so long as it talks sense.

BUT THERE IS DEVELOPING a new concept of industry-government relationship, an attitude of mutual responsibility which will bring new problems as well as new opportunities for petroleum and all industries.

Obviously the voters were not alarmed at the charges that the administration was too friendly to business. So their endorsement of this attitude means a continued political atmosphere favorable to business growth and progress—but with limitations.

For one thing, the people placed the executive and legislative branches in the hands of different political parties, which means that they want moderation, checks and balances, progress with caution, nothing very drastic one way or the other.

Also, the Eisenhower administration has hinted broadly at new political philosophies in the making. Other factors are the changed political lineups, and the younger men coming into public life.

All these add up to the setting for a swing toward what might be called a "new liberalism," or a new concept of "peoples' capitalism." The objective will be to encourage business to invest and expand in a prudent and orderly manner but constantly to guide and prod it toward more social benefits and greater public service.

SPECIFICALLY AS TO OIL, the election results should be interpreted as meaning that the industry will get a sympathetic and objective hearing in Washington but by no means a blank check for whatever it wants.

For example, enactment of natural-gas legislation can be expected provided the new bill recognizes the public interest in gas, admits to a degree of federal supervision, and is presented for the general welfare rather than for the benefit of one industry segment.

Likewise problems of imports, depletion taxation, and other things will be judged on the basis of contributions to long-range growth and broad economic progress rather than the desires of a dominant section of industry.

In short, the industry can plan on encouragement for its growth and progress—so long as it can keep a sympathetic but watchful administration convinced that it is working in the direction of greater service to the entire body politic.

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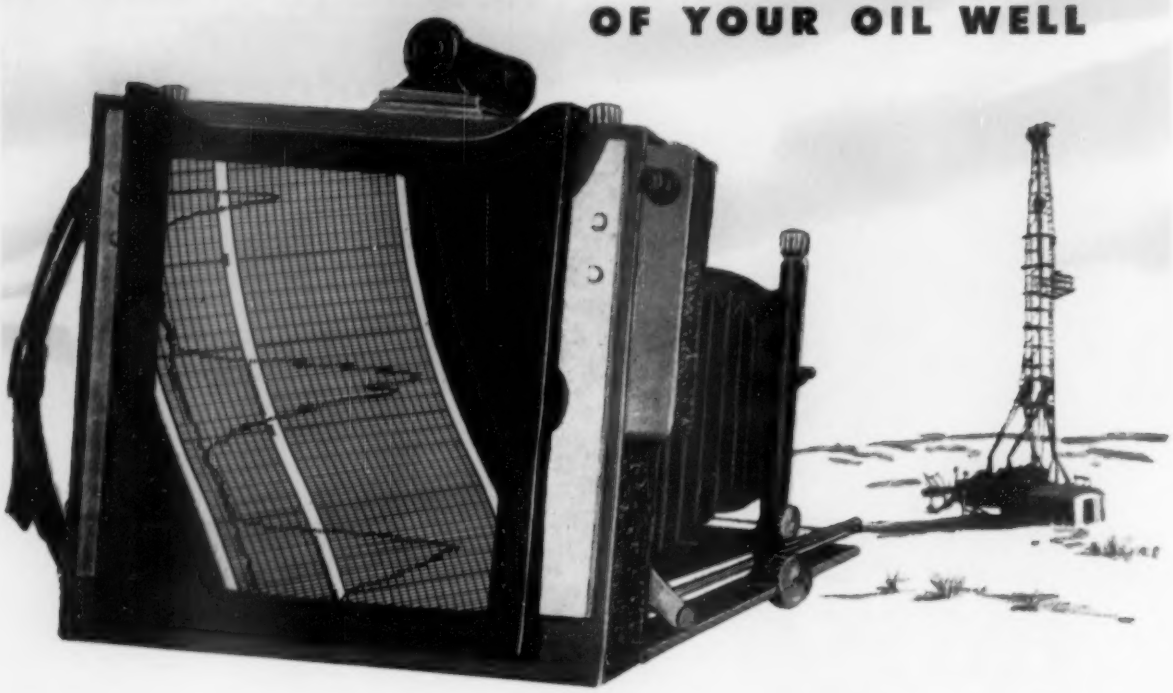

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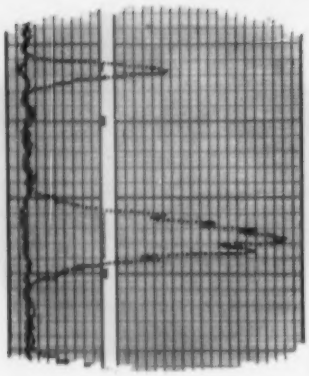

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Current and significant in . . .

The Industry This Week

Industry

• **Repercussions of Middle East hostilities** are being felt around the globe. With Suez blocked and pipelines cut in Syria, Britain and France are hunting for over 2 million barrels of crude daily. The hunt will create tanker shortages, tighten crude and products markets in the U. S., and scramble normal industry patterns of operations all over. P. 122.

The A.P.I. convention—oil industry's biggest annual gathering—will be held this week. More than 6,000 oil men are expected in Chicago for general sessions and various division meetings. P. 125.

A 30-hour work week by 1970 is goal of O.C.A.W. Other item on the union's timetable: Bigger pay checks to go with shorter hours. P. 128.

Pipelines

• **El Paso Natural has bought out** Pacific Northwest Pipeline thereby becoming the largest natural-gas transporting company in U. S. P. 130.

A 530-mile, 10-in. products system from West Texas to Houston is being planned by Gulf Oil Corp. as part of a $20 million project to bolster its position in natural-gas liquids. P. 132.

Work has started on the 212-mile, 20-in. crude line which will open up the Barinas-Apure basin in Venezuela. P. 142.

Favorable FPC decision is expected on Texas to Florida natural-gas line by early 1957. It will tap one of the nation's major markets now unserved by natural gas. P. 138.

Trans-Canada Pipe Lines now has been given until December 1 to prove its financial ability to complete the $370-million gas artery. P. 133.

"Plow" that digs a trench and then buries pipe underwater has passed tests made by Humble in Louisiana. It promises economical way to lay small pipelines in shallow water. P. 134.

Production

• **New technique for sealing off tubing-coupling leaks** has been developed by Humble and Otis Engineering Corp. It promises to save operators of medium-to-high pressure oil and gas wells both cash and headaches. P. 136.

Ratable take of natural gas is spreading in Texas. Railroad Commission will enforce it now in Puckett Ellenburger field in Pecos County, the sixth problem field to get ratable take. P. 141.

Refining

• **Sunray Mid-Continent has let contract** for a $10-million expansion program at its Tulsa and Duncan refineries. Aim is to set the plants up for producing 100-octane gasoline. P. 138.

Pacific Coast's first plant for turning out polyethylene, ethylene oxide, and ethylene glycol is on stream. It is operated by Carbide & Carbon at Torrance, Calif., and will use refinery gases from General Petroleum's nearby plant. P. 133.

Exploration

• **Navajo Indians have leased 112,130 acres** of their reservation in Utah and New Mexico for nearly $27½ million. Recent strikes at Aneth field made the land attractive to oil money. P. 135.

Promising exploration concessions in the Saar have gone to four West German oil companies. P. 143.

Suez Developments... ...And what they mean

1. Canal blocked by sunken ships	Normal movement of 1,500,000 bbl. of oil daily is cut off, possibly for several months.
2. I.P.C. system knocked out	Another 500,000 bbl. from Iraq is denied the western world.
3. Lebanon limits Sidon movement	Normal flow of 325,000 bbl. of crude through Tapline is greatly reduced.
4. Saudi Arabia closes Ras Tanura to Britain and France	This doesn't shut off all Saudi Arabian oil, but it will cut sharply into the amount which can be moved around the Cape of Good Hope for European consumption.
5. Rationing begins	European refineries have 30-40 days' supply on hand. As shortage nears, Britain and France move to conserve supply.
6. Europe turns to the U. S.	Crude and products already are tightening in New York and on the gulf. States talk higher allowables. U. S. may help finance purchases.

It all means that a . . .

Worldwide Oil Scramble Is Developing

BRITAIN and France's excursion into Egypt has jolted the oil industry the world over.

No matter what comes of the fighting, threats of sabotage, and diplomatic maneuvers over the Middle East, this much is certain:

. . . **Europe faces a serious** oil shortage that will last for months.

. . . **The oil industry's normal pattern** of transportation, marketing, refining, and production in every corner of the globe will be altered sharply.

American oil interests are deeply involved, too, and many company executives say privately the situation is serious and could become much worse. They face this ticklish job: Make their oil available to Europe in the crisis and still not endanger huge investments in the Middle East by angering the Arabs.

Costly error . . . The British and French already are beginning to pay a stiff price for guessing wrong in Egypt.

It is now evident they thought Egyptian forces would fold and retreat at the first sign of force after a softening-up period of bombing raids. They guessed wrong. The Egyptians fought back, asked for help from the Arab neighbors, and got it.

Egypt's Arab allies began moving last week to cut off oil supplies that are vital to both Britain and France. At week's end Britain and France had lost access to Middle East oil supplies except what they can move by tanker around the Cape of Good Hope from Iran, Iraq, and Kuwait.

This means they were cut off from:

. . . **1,500,000 bbl. daily** of oil that normally moves through the Suez Canal.

. . . **500,000 bbl. daily** moving through Iraq Petroleum Co.'s system from Iraq fields to eastern Mediterranean ports.

. . . **300,000 bbl. daily** from Saudi Arabian fields, both at Ras Tanura on the Persian Gulf and Sidon in Lebanon.

What happened . . . Loss of the more than 2 million barrels daily of oil came dramatically after British and French forces entered Egypt with the announced purpose of protecting the Suez from damage by Egyptian and Israeli hostilities.

This is what happened:

. . . **Suez Canal blocked.** From six to eight vessels, plus a bridge, were sunk in the 103-mile waterway. British officials say it will take at least 3 months to remove the debris, assuming an immediate end to hostilities and permission for engineers to enter the area.

. . . **Pipelines of I.P.C.** in Syria blasted. Three pump stations are out of commission with two of these reported wrecked. It may take as long as a year to restore them to full service. The line could be used at reduced throughput by stop-gap repairs, however.

. . . **Tapline embargoed.** This line from Saudia Arabia to Sidon is still open and capable of moving 325,000 bbl. daily to the Mediterranean. But the Lebanese have embargoed tanker liftings by British and French, denying 125,000 bbl. to these two nations.

. . . **Ras Tanura closed** to British and French. The Saudi Arabs banned any oil shipments to either country, thus effectively sealing off the two nations from all oil in Saudia Arabia. Britain and France had been lifting 175,000 bbl. daily there. So far, however, this oil still can be moved to other free-world nations.

Bridging the gap . . . Britain and France already have started to make up the loss of oil. They sent:

. . . Tankers moving around the Cape of Good Hope.

. . . Purchasing agents scrambling for crude supplies on the U. S. Gulf Coast and in Latin America.

In both instances a serious shipping shortage may develop because there is not enough surplus tanker tonnage to bridge the time-gap caused by the longer voyages.

If Britain and France can find the needed shipping and crude supply in the Western Hemisphere, they still face the serious problem of paying for the oil in dollars. Neither country has a large enough back-log of dollars to sustain a long crude-buying program in the West.

Effect on U. S.

The predicament of the British and French will have its effects on the U. S. It probably will mean:

. . . Tighter markets for crude and, later, products.

. . . Increased production allowables in the Southwest.

. . . Some form of government help to help finance the purchases.

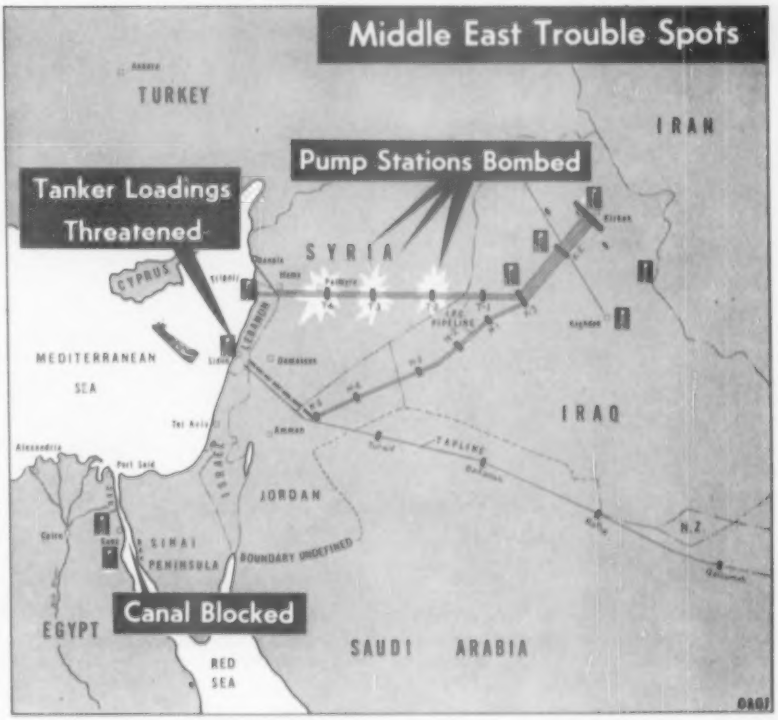
European refiners already have sent many inquiries to this country for spot crude. Estimates of the crude actually purchased run as high as 1,000,000 bbl. for November and early December delivery.

Gulf Coast refiners in the last 10 days have sold considerable distillate and diesel oil for shipment to European buyers over the rest of the year. That market already has tightened on the Gulf Coast. Shipments of the heavier oils to foreign buyers also have increased. There also is a feeling that the foreign demand for gasoline will tighten nearly any day. American refiners report that foreign buyers unable to buy all the crude they need for their own refinery operations will be forced to buy more and more products. If this materializes, it would also firm the inland gasoline markets.

May hold oil . . . Many U. S. companies are reluctant to accept the sudden extra crude business, even when they hold what once was considered excess inventories.

One large crude producing and purchasing company explained the reason. It will not sell crude from storage or from increased current deliveries until it has determined the changed needs of its own affiliates. Some of the large American companies have European affiliates they must serve. Others have been using some Middle East oil which they also must now replace.

Refiners on the U. S. East Coast and in Canada who import 300,000 bbl. daily of Middle East crude had taken no action last week to replace their supplies. Most of them have stocks on hand and many have tankers en route loaded with Middle East crude. They undoubtedly will have to compete later on the domestic market with Europeans for the needed crude.



At least one marketing official expressed the hope that the conservation agencies of Texas, Louisiana, and Oklahoma would go slowly in increasing their allowables. He declared it would be better for the industry to force buyers to use up excess stocks of gasoline and other refinery products before stepping up oil production. This would allow product prices to return to a normal and profitable relationship to present crude-price schedules, he said.

Look to Washington . . . A strong sentiment began developing in the industry last week that the Eisenhower administration must soon decide on its oil policy in the emergency to avert chaos.

A few company officials declared the U. S. couldn't desert Britain and France no matter how much their actions were condemned, because the western powers are all in the same boat so far as Middle East is concerned.

These same officials believe chaos will develop unless some government-sponsored agency is created to coordinate purchases of crude and products in this country and to coordinate shipping facilities to get the oil to Europe.

Also, direction from Washington may be needed before a satisfactory pipeline movement to the Gulf Coast can be worked out to increase the supplies available there. One official commented: "There will have to be some sitting around tables by experts in that field before it can be worked out."

Word in Washington was that government officials were keeping a close watch on the crisis but so far have not yet developed any firm plan of aiding European countries. Planning was halted abruptly when Britain and France entered Egypt.

Trends of Events

The entire series of Middle East events was set off when the Suez Canal became blocked.

The initial block came with the sinking of the Egyptian frigate Akka at the mouth of Lake Tismah near Ismailia, the canal's midpoint. The frigate was sunk during the second day of air raids on Egypt.

Egyptians blamed Anglo-French planes for the sinking. French and British say the Egyptians scuttled the vessel deliberately to block the canal.

Since that time, at least five and possibly six more small vessels have gone down in the canal. Most of them were small fishing vessels, but one was a cement and scrap iron-loaded LST. All were apparently sunk deliberately by the Egyptians to close the waterway.

In addition to the boats, the Egyp-

CENTER OF INVASION by British and French paratroopers in Egypt was Port Said, northern terminus of Suez Canal. Busy port facilities are shown in this aerial view looking north to the Mediterranean.

tians demolished supports of the swinging bridge El Firdan just south of Port Said and allowed the span to fall into the canal.

The British and French armed forces now in Egypt are ready to move into the canal area with special equipment to clear the waterway. But no one knows the size of the job they face. This will be known only when the fighting stops.

This much is conceded: Even if the workmen can do the job unhampered by guerrilla warfare, as Nasser has promised, it may take months to reopen Suez.

The pipelines . . . Since the very beginning of the Suez crisis, the Arab world has held a two-edge sword over European oil supply.

When Nasser took over the old Suez Canal company, he insisted he had no intention of either halting or slowing oil traffic through the canal. The British and French have always been skeptical that the 1,500,000 bbl. of crude that moved through the canal daily would flow uninterruptedly.

When the British and French first threatened use of force to loosen Nasser's grip on the canal, Egypt's Arab allies in Syria and Lebanon warned they would swing the second edge of the double blade. It would destroy the pipelines that carry another 850,000 bbl. of oil available to Europe.

Last week it was all too clear that Nasser's allies meant just what they said. Iraq Petroleum Co.'s pipeline system from the prolific Kirkuk field to Banias in Syria and Tripoli in Lebanon was out of operation.

The I.P.C. system to the eastern Mediterranean ports has not operated since about 10 p.m. November 3 when communications lines along the system were cut. The following day aerial observers said smoke was pouring from three of the pipeline pump stations.

It was still not clear last week whether pumps at the stations had been destroyed or whether the line itself had been blasted. If only the lines are cut, the system can be repaired and put back into service quickly.

Damaged pump stations would take longer to restore, but even then a long shutdown isn't likely. I.P.C. could bypass the pump stations and start operations while they are being repaired. This would cut down throughput, but at least some oil would reach the Mediterranean. I.P.C. could even boost this throughput by moving in portable pumping units on a temporary basis until stations were restored.

The damaged pump stations are T-2, T-3, and T-4. The latter is 111 miles inland from Tripoli and about 133 miles from Banias. T-3 is another 64 miles to the East, and T-2 is 81 miles farther toward Iraq *(see map)*.

After the pipeline system of 30-in., 16-in., and 12-in. lines was cut, there were no more tanker liftings of crude from either Banias or Tripoli.

Three days after the Syrian damage to I.P.C.'s system, the Lebanese government rushed reinforcements of its national police to the Tripoli area. Saboteurs had cut the I.P.C. line in Lebanon. It was an empty gesture. With the Syrian pump stations down, the line was not able to operate through Lebanon.

The Lebanese government earlier had impounded crude stocks at Tripoli to insure adequate crude supply for the 11,500-bbl. daily refinery there. The refinery has an estimated 50-day supply of crude from this storage. Both Syria and Lebanon would depend on this refinery for military petroleum products if fighting flares in that area.

Tapline in operation . . . Since the French and British have majority ownership in I.P.C., the company's pipeline system was the first target for Nasser's sympathizers in Syria. It was not clear last week whether Trans-Arabian Pipeline Co.'s system was spared the same treatment because of its American ownership.

Tapline was asking no questions, but it was still in operation. The system moves a little more than 326,000 bbl. daily from Saudi Arabian fields to Sidon on Lebanon's Mediterranean coast.

Egypt's oil operations . . . Except for a terse government announcement that Egypt has seized all British-French oil operations in Egypt, little is known of what has actually happened to oil operations in that country since the fighting started.

Anglo-Egyptian Oil Fields, Ltd., a

Royal Dutch-Shell company, operates a 44,000-bbl. daily refinery at Suez and also the country's major producing oil fields. Anglo-Egyptian's total production from fields on the western edge of the Gulf of Suez and from Sinai Peninsula fields, operated jointly with Socony Mobil Oil Co., is about 31,800 bbl. daily.

The only other operating oil company in Egypt is International Egyptian Oil Co., Inc. It is owned by Belgian Petrofina, Azienda Generale Italiana Petroli (AGIP), the Italian-Government company, and Swiss interests. International Egyptian produces about 7,500 bbl. daily from Feiran and the rapidly developing new field, Belayim, on the southern tip of the Sinai Peninsula.

The entire Sinai Peninsula was overrun by Israeli forces. There have been no reports on the fate of the oil fields operating there nor of personnel in the fields.

Sahara Petroleum Co., exploring a vast area of Egypt's western desert on behalf of Continental Oil Co., Ohio Oil Co., Cities Service Co., and Richfield Oil Corp., suspended operations at the outbreak of hostilities.

More than 100 members of the families of Sahara personnel were evacuated from Egypt just before the fighting began. All but a few of Sahara's personnel have been evacuated from its headquarters in Alexandria. The company is drilling three wildcats in the 60,000,000-acre concession it holds in the western desert.

Other Arab countries . . . The remaining Arab countries in the Middle East were reported quiet in the wake of token protest riots which followed the Anglo-French invasion of Egypt.

British troops moved into Bahrain after rioting there. Disturbances were confined to native sections of the country. There was no damage to the 250,000-bbl. refinery of Bahrain Petroleum Co., Ltd., or to the oil fields.

Saudia Arabia was reported calm internally with oil operations proceeding normally.

Kuwait also reported normal oil operations.

Shipping Problem

The big question of whether to make the long haul around the Cape of Good Hope was settled last week.

Shippers waited several days after Anglo-British forces started bombing Egypt to decide.

At first oil and shipping companies ordered a "slow down" for vessels nearing the canal, or ordered them berthed temporarily. They began sending all tankers around the cape last week when it became apparent the

SUEZ IS BLOCKED by this Egyptian ship sunk near Lake Tismah about midway in the canal. Despite results of any cease-fire negotiations, canal is expected to be blocked for months by this and other sunken ships.

military action would not be over "in 2 or 3 days."

Shippers estimate it costs about $2,500 a day to operate a tanker, plus another $750 to $800 for bunker fuel. This makes the 9 to 15 days extra steaming time around the Cape an expensive proposition. Expensive or not, Western Europe has to have the oil.

The world tanker fleet totals 41,600,000 deadweight tons. But far from all of it is used in the Middle East-to-Europe trade. Experts say the tonnage committed to this trade must be increased 40 per cent to compensate for loss of the canal and the longer voyage around Africa.

Cape traffic complications . . . Rerouting all normal Suez Canal shipping around the Cape of Good Hope is not the simple operation it might appear on the surface. It can, and probably will, result in some pretty chaotic conditions at South African ports, the normal bunkering ports for such an extended voyage.

South American port authorities took a quick look at these facilities when the Suez crisis first arose last summer. At that time they said port and bunkering facilities would be available first to the shippers who have normally used them in the past. Others would have to wait if the situation deteriorated enough that shipping began to engulf the ports. This would mean a further time-lag in Europe's oil-supply line.

Tankers making the longer haul around Africa to Western Europe will have to refuel once, twice, or even three times according to their size and speed. At normal average speeds, a 30,000-ton vessel has a range of about 7,000 miles without refueling. The range of a 15,000-ton tanker is about 3,000 miles.

A 30,000-ton tanker making the Persian Gulf-to-Europe run would need to refuel only at some South African port, probably Durban or Cape Town. But, a 15,000-ton tanker probably would have to refuel three times during its trip around Africa.

European Supply

Europe's present supplies . . . After word reached London last week that the Suez Canal actually was blocked, Harold Watkinson, British minister of transport, conceded "there will have to be some restriction of oil consumption in this country."

It wasn't long in coming. In midweek, Fuel Minister Aubrey Jones announced in the House of Commons the Government was ordering an immediate 10 per cent reduction in domestic consumption of oil and gasoline. He said the move was made to space out diminishing supplies reaching Britain from the Middle East.

Jones warned further that a rigid rationing system would be introduced if there were undue delays in clearing the Suez Canal and putting damaged Middle East pipelines into service.

France likewise made appeals to its people to cut down consumption and prepared restriction on pleasure driving.

Watkinson said the British Government has a "complete plan" for diverting tankers around the cape. He admitted the longer tanker voyage would create a serious gap in Britain's oil supplies. He said British oil stocks have been building for the past 2 months. "All our stocks are as full as they can be," he declared.

The big question is whether that will be enough. The normal tanker run from the Middle East through the canal has been so regular and uninterrupted that British and other European refineries have had no need for extensive crude storage.

Informed sources say privately they doubt if Western Europe's refiners have more than 30 days crude supply in storage—in spite of the stock build-up since the Suez crisis flared.

The daily refinery throughput in the 17 European nations that make up the Organization for European Economic Cooperation was almost 2,100,000 bbl. last year. Of that total only about 134,000 bbl. daily was produced domestically. The remaining 1,960,000 bbl. daily was imported crude. Almost 91 per cent, or about 1,784,000 bbl. daily came from the Middle East.

Tanker Survey Ordered

NPC study will be basis for next step in U. S. building program; lack of facilities may crimp big tanker goal

WASHINGTON.—The National Petroleum Council will make a quick study of probable U. S. and world-wide tanker construction as far ahead as 1965. It will be the basis for further steps on the President's proposal to launch a big tanker-building program.

The survey will be made at the request of Assistant Interior Secretary Felix A. Wormser. Two meetings with tanker interests indicated to him that the industry itself is not prepared now to undertake a construction program larger than that already planned.

Requests of the department for NPC studies ordinarily are made at council meetings. But the NPC has an emergency procedure which provides for urgently needed surveys before meetings. Under that procedure, Chairman Walter S. Hallanan immediately set up a committee on petroleum tanker requirements, to be headed by B. Brewster Jennings, chairman of Socony Mobil Oil Co.

Short of facilities . . . In his letter to Hallanan, Wormser disclosed that meetings had been held between Mobilization Director Arthur S. Flemming, members of the cabinet, and representatives of the NPC and the tanker interests. They learned that a lack of shipyard facilities might make impossible any big program for building 60,000-ton or larger tankers.

Flemming reported that foreign shipyards appear to be fully occupied with tankers under construction and orders placed which would keep them busy at least through 1960.

There is potential capacity in American shipyards. But Flemming emphasized that government support would fall short of putting up money. Tankers would have to be built on a self-liquidating basis with no direct financial aid from the Government.

Industry representatives declared there already are financial problems with tankers built in American yards. But a large program for building big tankers is under way and will be expanded. It was suggested that in view of these plans the fleet might be adequate to meet the President's aim of getting a tanker fleet adequate to insure world supply in the foreseeable future.

America lags . . . The long-term survey got under way as warnings came that the U. S. is lagging in tanker construction.

Shipbuilding, world wide, is at its highest point since the World War II boom, the American Merchant Marine Institute reported. And tanker orders for over 17,000,000 tons constitute 55.5 per cent of the 31,000,000 dwt. of ocean-going merchant vessels on order.

The United States is not keeping pace with other countries. With 14.3 per cent of the world's tanker fleet, orders for private U. S. flag account total only 529,000 tons, or 3 per cent of the world construction.

The United Kingdom is far in the lead, with 20.5 per cent of all tanker tonnage building, followed by Norway with 15.6 per cent; Liberia, 12.9 per cent, and Panama, 6.8 per cent.

"The world's tanker fleet continues to show the most significant changes in the postwar period," the institute commented. "By midyear this fleet totaled 41,000,000 dwt., or almost 2½ times the tanker tonnage in being at the outbreak of war in 1939. On completion of current orders, the world fleet of tankers will total 58,400,000 tons, or almost 3½ times the tonnage in existence in 1939."

"Short Week" Gets Target Date

DENVER.—Target date for labor's 30-hour work week with a beefed-up take-home pay has been set for 1970 by the Oil, Chemical, and Atomic Workers International Union.

A timetable released by the organization reveals it will seek its objective in a series of steps, each designed to bring about shorter hours and bigger pay checks. The increases are based on the value of the dollar in 1954.

While the union says the table is based on a 30-hour week by 1970, it actually is pegged to 31 hours, according to the hourly rates listed. But here's what it means in terms of dollars to:

. . . Refining. Hourly rates in 1970 would be nearly 60 per cent above the 1954 scale. This means each worker would take home $20.95 more each week in "real dollars" than he did in 1954. The table is based on an average weekly scale of $96.22 in 1954 and $117.18 in 1970.

. . . Petroleum production. Pay would be boosted from the 1954 average of $91.94 weekly to $112.53 weekly by 1970, an increase of $20.59.

. . . Chemicals and allied products. Pay checks would jump from the weekly average of $78.50 to $94.55, a $16.05 increase.

The union stressed that "if prices should rise, wages would increase above the rates reported in the model in order to maintain the productivity ratio. The increases in earnings, as shown, are increases in actual purchasing power."

Opening wedges toward the goal will be driven during negotiations for 1957 contracts. The talks will start shortly after the union's bargaining-policy committee sets contract demands at a meeting in Denver December 7.

E. E. Phelps, director of O.C.A.W.'s research and education department, pointed to automation as the key to the 30-hour week. He declared that "while many industries have sharply increased output through automation, employment has been slipping or has failed to grow significantly."

O.C.A.W.'s Timetable for Raises

(Rates based on 1954 dollar value)

	1954	1960	1965	1970
ALL MANUFACTURING:				
Hourly wage	$ 1.81	$ 2.18	$ 2.52	$ 2.89
Weekly wage	71.86	80.22	87.44	89.59
PETROLEUM REFINING:				
Hourly wage	2.37	2.86	3.30	3.78
Weekly wage	96.22	105.25	114.51	117.18
CHEMICALS, ALLIED PRODUCTS:				
Hourly wage	1.91	2.30	2.66	3.05
Weekly wage	78.50	84.64	92.30	94.55
PETROLEUM PRODUCTION:				
Hourly wage	2.27	2.74	3.16	3.63
Weekly wage	91.94	100.83	109.65	112.53

These men will address general sessions . . .

JAKE L. HAMON

FRANK M. PORTER

FRANK O. PRIOR

THOMAS J. WATSON, JR.

FRED F. FLORENCE

Big A.P.I. Meeting Gets Under Way

CHICAGO.—This week, Chicago is the oil capital of the world.

Approximately 7,000 oil men from all parts of the nation are here to attend the thirty-sixth annual meeting of the American Petroleum Institute.

As in previous years, the nation's largest annual oil convention is being conducted in the Conrad Hilton, Palmer House, and Sheraton-Blackstone hotels.

Banking, government, and other subjects are scheduled for discussion at the two general sessions, in addition to oil-industry topics. Both sessions will be in the Conrad Hilton's Grand ballroom.

Presiding at the first general session, which begins at 9:30 a.m. Wednesday, will be Jake L. Hamon, independent operator from Dallas, who is chairman of the Institute's board of directors.

Secretary of Interior . . . Frank M. Porter of Fain-Porter Drilling Co., Oklahoma City, president of the A.P.I., will make opening remarks, followed by an address by Fred A. Seaton, Secretary of the Interior, Washington.

At this same session, J. Frank Drake, former president and board chairman of Gulf Oil Corp., Pittsburgh, will receive the A.P.I.'s 1956 Gold Medal for Distinguished Achievement (*The Oil and Gas Journal, October 29, page 69*).

Thursday's speakers . . . The general session Thursday will feature addresses by Frank O. Prior, president of Standard Oil Co. (Ind.), Chicago; Thomas J. Watson, Jr., president of International Business Machines Corp., New York City; and Fred F. Florence, Dallas, president of the American Bankers Association.

In addition to the two general sessions and 14 group sessions, scores of individual technical committee meetings were scheduled. Many committee meetings were held last week.

Oil Industry Information Committee

CONGER REYNOLDS
(retired)
Standard Oil (Ind.)

D. R. McCALLUM
Sinclair Refining

R. B. GLASS
Socony Mobil

A. J. DE BLOIS
De Blois Oil

R. A. DOUGLASS
Ethyl Corp.

A.P.I. Honors Outstanding Oil Men

CHICAGO—Thirty-four oil men from many parts of the United States will be singled out at the A.P.I. meeting here this week for their outstanding contribution to the oil and gas industry.

Representing diverse segments of the industry, they come from California, Texas, Rhode Island, Oklahoma, New York, Missouri, Pennsylvania, Illinois, Colorado, and Michigan.

They are men who have excelled in their particular phase of the oil and gas industry, be it production or public relations.

Ten of the "certificates of appreciation" will be awarded for distinguished service to the Institute's division of transportation.

Eight men will be cited for their contribution in the field of production.

Five leaders in the Oil Industry Information Committee will receive certificates for their efforts in the oil industry's concerted public-relations program.

Three will be honored for fundamental research work, and three for marketing.

One certificate will be presented for work in each of these categories: petroleum reserves, American Petroleum Industries Committee, crude-oil measurements, safety and fire protection, and finance and accounting.

Ralph R. Clagett, who before his death last year was assistant comptroller with Pure Transportation Co., Chicago, will be cited posthumously.

Most of the certificates will be presented at group sessions, 14 of which are scheduled at the 4-day meeting.

Group sessions scheduled Monday are: medical and health, division of finance and accounting, public relations, division of transportation, fundamental research and division of refining.

On Tuesday group sessions include division of finance and accounting, division of marketing, division of production, American Petroleum Industries Committee, and division of marketing.

Wednesday, group sessions will be held on production, petroleum statistics, and safety and fire protection.

Division of Transportation

W. B. JUPP
Socony Mobil

R. D. WYCKOFF
Gulf Research

R. J. WHITLEY
Socony Mobil

J. L. SHOEMAKER
Service Pipe Line

C. S. JONES
Richfield Oil

G. H. HILL, JR.
Cities Service

P. J. BOND
Pure Oil Co.

M. G. GAMBLE
Esso Shipping Co.

R. J. WALSHE
The Texas Co.

R. R. CLAGETT
(deceased)
Pure Transportation

W. F. HERBERT
The Texas Co.

S. S. PARKER
National Tank Co.

F. P. HAYES
California Texas

J. C. SLONNEGER
Continental Supply

W. O. CLINEDINST
National Tube

Division of Production

C. D. NORRIS
The Texas Co.

Safety and Fire Protection

W. V. VIETTI
The Texas Co.

JOHN WOODRUFF
Texas University

C. E. BEECHER
Cities Service

J. G. JORDAN
Shell Oil Co.

Division of Marketing

Fundamental Research

G. M. KNEBEL
Standard Oil (N. J.)

F. R. MARKLEY
Sun Oil Co.

D. T. COLLEY
Atlantic Refining

W. G. LOVELL
Ethyl Corp.

R. E. WILSON
Standard Oil (Ind.)

Finance and Accounting

P. C. SALMAN
Socony Mobil

Crude-Oil Measurements

O. D. STALLARD, JR.
Magnolia Pipe Line

A.P.I.

DAVID PROCTOR
Gulf Oil Corp.

Petroleum Reserves

M. J. DAVIS
Humble Oil

Pacific Northwest Sold

● El Paso Natural becomes an even bigger pipeline giant through purchasing 1,466-mile system running from San Juan basin to Washington State

EL PASO.—El Paso Natural Gas Co. last week acquired Pacific Northwest Pipeline Corp. in a deal which makes it a rival of Tennessee Gas Transmission Co. as the nation's biggest transmission company.

El Paso will absorb Pacific Northwest through a stock exchange involving around $140,000,000. The company will issue seven shares of its own stock in exchange for eight of Pacific Northwest. Quotations last week were 42¾ for Pacific Northwest and 56⅞ for El Paso.

The deal is the culmination of talks which were reported under way even before Pacific Northwest laid a single joint of its 1,466-mile, 22 and 26-in. system from Ignacio, Colo., in the San Juan basin to the Canadian border. It cements El Paso's position as the dominant gas-transmission company in western United States.

The merger must, of course, be approved by the Federal Power Commission before it becomes effective.

Assets, operations . . . Addition of Pacific Northwest's $119 million in assets will place El Paso Natural close to the billion-dollar category.

Together the companies will transmit upwards of 2½ billion cubic feet of natural gas per day.

The line which Pacific Northwest is completing through Colorado, Utah, Wyoming, Idaho, Oregon, and Washington will have initial capacity of 343,000,000 cu. ft. daily. Current expansion gives El Paso capacity of more than 2,000,000,000 cu. ft. daily into California, its principal market supplied by fields in the Permian and San Juan basins.

The merger joins two of the fastest-moving companies in the industry. Pacific Northwest, founded 6 years ago by Ray C. Fish, now the company chairman, has entered into production heavily and is negotiating for refining properties. El Paso, headed by Paul Kayser, president, has branched over into producing, refining, and marketing.

Evolution of deal . . . El Paso Natural opposed the Pacific Northwest project in its early stages.

The company was known to be interested in the Oregon-Washington area, although it professed to be interested in California alone. Then came reports of a deal in the offing for El Paso to take over the project. But nothing came of these talks. Pacific Northwest finally lined up financing for the $163,000,000 line early last year and the "paper pipeline," on the drawing boards for 5 years, finally became a reality.

Pacific Northwest will mesh perfectly with El Paso Natural operations. Fish's company at first will move gas north from the San Juan basin and south from Canada.

Reversal of line . . . But both companies have been looking ahead to the time when the Pacific Northwest line will be reversed and Canadian gas will flow all the way to California through the two systems.

The Canadian supplies from British Columbia and Alberta would be the major source for California, supplemented by San Juan reserves.

This reversal is expected to come within 7 years.

Big Texas Sale Set

December 4 is auction day on roughly 100,000 acres

AUSTIN.—Oil and gas leases on 100,000 acres in Texas will be up for grabs here December 4 in one of the state's biggest lease sales.

On the auction block will go leases on more than 92,000 acres of state-school lands, 4,825 acres of "Relinquishment Act" lands, 8,020 acres of prison lands, and 60 acres of state fish-hatchery lands.

Roughly 8,000 acres of the state-school lands, comprising 15 tidelands tracts off Galveston and Jefferson counties in the Gulf of Mexico, will be leased for sulfur development only.

Another 10,000 acres of state-school tidelands will be offered for oil and gas leasing. These include 15 tracts, approximately a section each, off Jefferson County and one off Matagorda County.

Bulk of the state-school acreage, roughly 68,500 acres, is submerged lands underlying coastal bays, rivers, lakes, and bayous. Another 5,500 acres of upland leases will be sold in Culberson, Reeves, Duval, Gaines, Pecos, Roberts, Stephens, Stonewall, and Yoakum counties.

Drilling block . . . The big sale includes one drilling block, a 2,579-acre chunk of relinquishment-act land in Pecos County, West Texas. These lands were sold in the past to private owners, but the state retained mineral rights.

The Pecos County block is in Block 3, T. & P. R.R. Co. Survey, and includes Sections 145, 146, 150, and the north halves of 187 and 188. It calls for an Ellenburger wildcat to be spudded within 180 days of the lease date and carried to 16,000 ft.

The prison-farm lands up for lease are located in Brazoria and Walker counties. The fish and game commission will take bids for a lease on 60 acres of its state fish-hatchery grounds in Tom Green County.

Rubber-Plant Buyers Scarce

WASHINGTON.—The Federal Facilities Corp., successor to the Rubber Disposal Commission, found last week that neither the oil, rubber, nor chemical industry has any great urge to take over the Government's alcohol butadiene plant at Louisville, Ky.

Only two companies had made offers to lease the plant when bids were opened this month. They came from Publicker Industries, Inc., which now holds a lease on the plant due to expire April 4, 1958, and Union Carbide & Carbon Corp., whose offer to buy the plant earlier this year was turned down by Congress.

Negotiations are now going on with the bidders, to be wound up by December 15. If a new lease is negotiated it will be submitted to the attorney general for approval and then transmitted to Congress at the opening of the 1957 session.

Arctic Drilling Scheduled

EDMONTON, Alta.—Peel Plateau Exploration, Ltd., plans to drill for oil in the Arctic Circle, 300 miles north of Dawson City, Yukon.

Peel, which holds exploration rights on 8,000,000 acres in the northwest territories and in the Yukon, has carried out extensive geophysical studies in the area since late in 1953. It reportedly plans to dig as many as four holes.

Transportation companies have been asked to bid on hauling equipment 1,700 miles from Edmonton over the Alaska Highway to Dawson City. Cat trains would take over from there.

Tidelands Stand Hit

California attorney charges commission's classification of wildcat acreage is costing state millions of dollars

OS ANGELES. — A Los Angeles attorney last week charged that the overnor and state legislature were nisled and deceived" by authors of ne Cunningham - Shell Act, the bill hich opened up the bulk of Cali-rnia's tidelands to exploration and evelopment.

Attorney Phill Silver asked the Cali-rnia Supreme Court for a writ of andamus which would vacate a recent ate lands commission determination at a 5,600-acre offshore parcel near ne Los Angeles-Ventura county lines , in wildcat area.

He further asked the court to restrain ne commission from making any more offshore parcel classifications without use of geophysical information.

Silvers declared that all of California's offshore acreage would automatically become wildcat territory if the state lands commission's method of classifying submerged lands is followed.

He pointed out that the commission requires proof of an actual producing well in operation before taking an offshore parcel out of the wildcat category. As a result, he continued, the state stands to lose millions of dollars in royalties.

The law . . . Under terms of the Cunningham-Shell Act, before a tidelands parcel can be put up for bonus bidding, the state lands commission must rule whether it is on a "known geological structure of an oil or gas field."

If the commission rules it is, then the royalty rate is on a sliding scale, beginning at a minimum of 16⅔ per cent. If it is labeled wildcat land, the royalty rate is established at a flat 12½ per cent.

The 5,600-acre parcel named in the suit was slated to go up for bonus bidding November 12, with bids closing January 15. This parcel is the center section of a 16,700-acre lease originally requested by the C.U.S.S. group. However, at its last meeting, the commission decided to put up only the 5,600-acre parcel at this time.

A 5,500-acre parcel off Summerland in Santa Barbara County is currently up for bidding. Bids on this parcel, which has been classified as a wildcat area, will be opened December 28.

JOHN P. O'DONNELL

ROBERT B. BIZAL

GENE T. KINNEY

lournal Enlarges Its Staff

HE OIL AND GAS JOURNAL has added two new editors to its staff nd given a third editor new assign-ients. The moves are designed to in-ease Journal coverage of the petro-um industry in depth, particularly in wo important areas.

Involved in the changes are:

. . . John P. O'Donnell a veteran l-industry editor, who has joined the ournal's staff in New York. He is the ournal's fourth editor in New York, n increasingly important center for ews of international oil as well as for evelopments in management and fi-ancing of domestic operations.

O'Donnell is an alumnus of St. Vincent College, Latrobe, Pa. He was oil editor of the Oil City (Pa.) Derrick before joining the Journal in 1940 in the New York office.

He later served the oil industry as deputy director of the Oil Industry Information Committee and was executive secretary of the transportation and international trade sections of the New York Board of Trade before rejoining the Journal as New York district editor.

. . . Robert B. Bizal, who has joined the Tulsa staff as a district editor. He is a graduate of Oklahoma City University and served for a time as assistant oil editor of the Oklahoma City Daily Oklahoman before studying abroad under a Fulbright scholarship.

On return from Europe, Bizal worked for the United Press in Oklahoma City, later served as associate editor of the I.P.A.A. Independent Monthly, and then spent a year as Kansas-Oklahoma district representative of the Oil Industry Information Committee.

. . . Gene T. Kinney, a Tulsa district editor, who has been promoted to assistant pipeline editor to enlarge the Journal's technical and news coverage of this segment of the petroleum industry.

Kinney is a graduate of the University of Oklahoma where he later did post-graduate study. He was a staff member of the Associated Press in Oklahoma City for 6 years before joining the Journal in 1955.

Products Line Planned

● Gulf is making its first move in natural-gas liquids since Warren merger with products line to Gulf Coast

HOUSTON.—When Gulf Oil Corp. acquired control of Warren Petroleum Corp. this year, the main reason was to bolster its position in the manufacture, transportation and marketing of natural-gas liquids.

Now the companies are making their first major move to take advantage of that merger.

The project, involving an outlay of almost $20,000,000, will include:

. . . **A 530-mile, 10-in.** pipeline system to move L.P.G. and natural gasoline from Crane County, West Texas, to the Gulf Coast near Houston (see map). There will be new construction at either end of the system but the middle will be a converted crude line owned by Gulf.

. . . **Fractionating facilities** near Mont Belvieu, in the Houston area, to separate products commingled in the line.

. . . **Underground storage** in the Barbers Hill salt dome of Chambers County, near the pipeline terminal. Storage capacity is expected to be as large as any similar installation in the industry.

Pipeline construction . . . Construction was started last week by Panama-Williams Corp., Houston, on the 46-mile, 10-in. section from Gulf's Waddell plant to Midland. A gathering system of 6 and 8-in. lines will funnel products from other West Texas and southeastern New Mexico plants into the common carrier.

Gulf will convert the Midland-Lufkin section of its old crude line to products service. This has been supplanted by the 26-in. pipeline built by West Texas Gulf Pipe Line Co. An additional 116 miles of 10-in. will be laid from Lufkin to the coast.

Pump stations will be built at Coahoma, Eastland, Dawson, and Lufkin.

Capacity of the system has not been announced, but it will be several thousand barrels daily. A similar line from the area can pump 25,000 bbl. daily. Completion date depends on delivery of steel.

Terminal, storage . . . Extensive storage facilities were approved several months ago by the Texas Railroad Commission.

Storage wells are being washed out of salt at Barbers Hill field. They should be completed and ready for use next spring. Fractionating towers will be erected later.

Handling of products . . . The project is a good example of the type of integration envisioned in the merger.

Up to now Gulf has engaged in the L.P.G. and natural-gasoline fields only incidentally to its other operations. With Warren, it has been the other way around. After pioneering in the oftenhectic business, it has become a leader, with marketing outlets in all 48 states. The merger permits Gulf, through Warren, to compete on a par with other majors who have concentrated on this phase of the business and to coordinate operations wherever warranted, as in the case of the new project.

Gulf Refining Co. will build and operate the pipeline. When the products reach the terminal, Warren will take over. It will own the storage and will handle the marketing through its huge barge, tanker, and tank-car fleet.

Besides augmenting the products which Warren can market through established facilities, the project has numerous other possibilities. It will make available a large volume of butane and propane for sale as feed stock to plants along the burgeoning petrochemical row lining the coast and Houston Ship Channel.

Warren also owns a 300-acre tract of land nearby on the San Jacinto River which could be used as a plant site for itself or Gulf, or sold to a company it could supply. Gulf has a sizable demand for natural gasoline for blending at its 245,000-bbl. Port Arthur refinery a few miles up the coast.

The companies also have the option of isomerizing or reforming the liquids into high-octane blending components which are in demand by Gulf Coast refiners.

Other lines . . . This will be the third major natural-gas liquids line from West Texas to the Gulf Coast.

Magnolia Petroleum Co. is moving L.P.G. through an 8 and 10-in. line converted from crude service early this year. Capacity is 25,000 bbl. daily. Phillips Petroleum Co. is operating a converted crude line purchased from Shell Oil Co.

Canadians Ask Wage Increase

WINNIPEG, Man.—A wage increase of 12½ per cent will be demanded in 1957 oil industry contracts covering Canadian members of the Oil, Chemical and Atomic Workers International Union.

The goal was adopted at a meeting of O.C.A.W. District 16 Council here. The 1957 bargaining program also includes demands for shift differentials of 15 and 20 cents, double time for all overtime, and premium pay for regular Sunday work for shift workers. The delegates expressed opposition to long-term agreements and cost-of-living escalators.

Representatives of Canadian O.C.A.W. chemical workers voted to seek "substantial wage increases" in present and upcoming negotiations and elimination of alleged wage inequities within a bargaining unit between plants of the same company and within the industry.

Trans-Canada Gets More Time

OTTAWA. — Trans-Canada Pipe Lines, Ltd., now has until December 1 to prove financial ability to complete the $370-million transcontinental gas line. The earlier deadline was November 1.

Canada's Board of Transport Commissioners granted the 1-month extension on request of Trans Canada, who informed the board that financial arrangements for the pipeline should be completed within the month.

The firm has only a conditional permit to build the line from eastern Canada to Winnipeg. The 575-mile western leg from Winnipeg to the Alberta border is already well under way. In fact, plans are being made for an early tie-in of two spreads, at which time there will be more than 200 miles of main line in the ground.

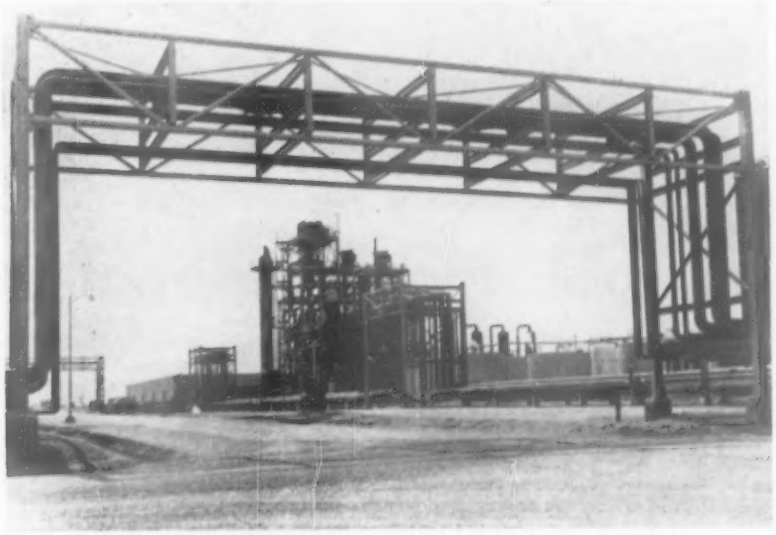
Trans-Canada plans to issue $144 million in first mortgage bonds. Another $90 million will be issued in junior securities, this being divided into approximately $60 million in debentures and $30 million in common stock.

Governments' participation . . . The Canadian Government and the Ontario Government are putting $120 million into the northern Ontario section of the line. Trans-Canada's sponsors have already contributed $15 million.

On November 1, the federal Government advanced an $11,500,000 loan to the company toward financing the western leg, bringing to $33,750,000 the total so far advanced for that section.

Behind schedule . . . Before the 1-month extension on financing was granted, the transport board learned that construction on the western leg had fallen far behind schedule. Completion is not expected until late next summer.

The original completion date for the western leg was set for the end of 1956. The steel strike in the United States delayed construction, and the completion date was extended to early 1957.



California Petrochem Plant on Stream

TORRANCE, Calif. — The Pacific Coast's first petrochemical plant turning out polyethylene, ethylene oxide, and ethylene glycol has gone into production on a round-the-clock schedule.

The plant is operated by Carbide & Carbon Chemicals Co., a division of Union Carbide & Carbon Corp. It stood full-dress inspection early this month for more than 500 representatives of coast manufacturing firms which use petrochemicals.

Located on a 140-acre site, the installation is largely controlled by automation. Feed stock is refinery gases from the nearby General Petroleum Corp. refinery. The plant was built by four California firms, the J. H. Pomeroy Co., Ford J. Twaits Co., Walsh Construction Co. and Kewit & Early.

Construction was started early in 1953 as part of an expansion program which included similar facilities at Seadrift and Texas City, both in Texas. Other plants are at Whiting, Ind.; Institute and South Charleston, W. Va.; and Niagara Falls, N. Y.

Industry BRIEFS

The Interstate Oil Compact Commission will hold its 1957 annual meeting in Tulsa December 2-4 as a part of Oklahoma's semi-centennial observance. Headquarters for the 3-day event will be the Mayo Hotel. The group last met in Oklahoma in 1946.

Georgia has upped its ante for the operator who brings in a good discovery well in the state. Every county approved a constitutional amendment to provide a bonus of $250,000 for the first well of 100 bbl. a day or more. The previous bonus was $100,000 for a 250-bbl. producer.

Geologists have reported surface structural and stratigraphic features that indicate possible oil and gas-producing formations. But more than 100 wildcats, dating back to 1901, have failed to measure up.

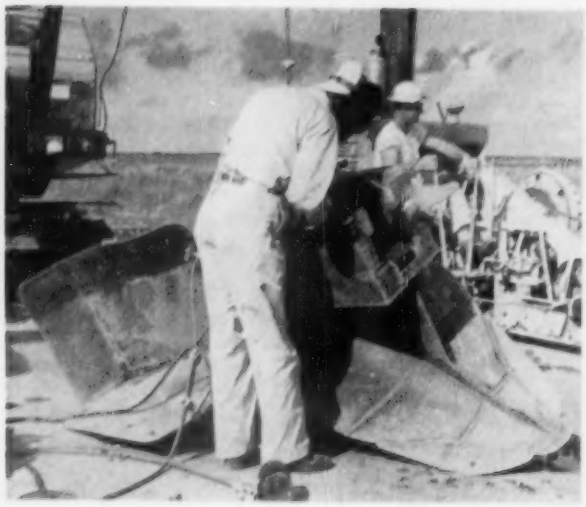
Gulf Oil Corp. has ended purchaser proration of Oklahoma crude after 4 months. The firm cut its purchases by 25 per cent last July 1 in defiance of an Oklahoma Corporation Commission order which required buyers to take full well allowables.

Gulf lost a bid in federal District Court for an injunction on the grounds of unconstitutionality, but evidence is being reviewed by the Circuit Court of Appeals to determine whether the order interfers with interstate commerce. A decision is expected soon. Meanwhile, Oklahoma's allowable has been cut 20 per cent from what it was when the squabble started.

Humble Oil & Refining Co. has submitted a bid of $278,754, the only bid made, for an oil and gas lease on 538 acres of government land within Perrin Air Force Base in Grayson County, North Texas. The land is being offered for lease to prevent wells on adjoining privately-owned acreage from draining oil sands underlying the air base.

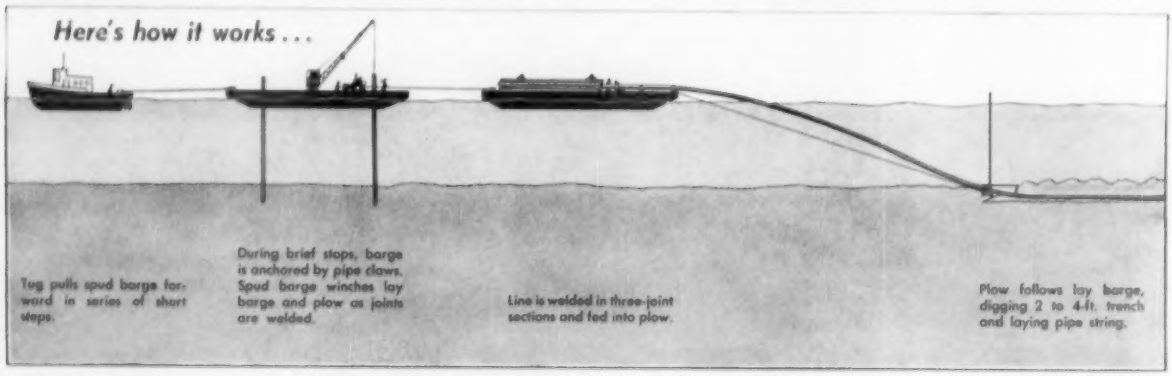
Oklahoma's November crude allowable has been set at 565,000 bbl. daily. The per-well quota remains unchanged from last month, but a state-wide boost of 5,000 bbl. daily was made to cover new production. The quota for last month represented a 41,000-bbl. daily cut from September.

Jupiter Oils, Ltd., has completed the acquisition of all the assets of Pawnee Oil & Gas Co., Tulsa. The deal gives Jupiter an interest in 187 oil and gas wells with proved reserves of 6,370,000 bbl. of oil and 118,740 M.c.f. of gas.



Huge underwater plow is readied for . . .

. . . Laying pipe in south Louisiana bay.


Here's how it works . . .
Tug pulls spud barge forward in series of short steps.
During brief stops, barge is anchored by pipe claws. Spud barge winches lay barge and plow as joints are welded.
Line is welded in three-joint sections and fed into plow.
Plow follows lay barge, digging 2 to 4-ft. trench and laying pipe string.

Oversized Farm Tool "Plows" a Pipeline

GRAND ISLE, La.—An underwater plow which digs a trench and threads pipe into it in one operation has been successfully tested in southern Louisiana bays by Humble Oil & Refining Co.

The company revealed last week that the submerged plow, digging a furrow 3 to 4 ft. deep, promises to cut the cost of laying small pipelines in shallow water.

One job on which the combination trench digger and pipe layer was used involved laying 35,000 ft. of 4-in. gas line beneath Cote Blanche Bay south of Morgan City, La. The pipe was lowered 3 ft. beneath the natural mud bottom. And the whole operation required only 2 days.

Resembling an oversized farm plow, the implement is about 4 ft. square, weighs 1,000 lb., and costs $900.

It was designed several years ago by B. B. Box, Humble welding supervisor at Bayou Sale. The invention won him $200 award under the company's Coin - Your - Ideas incentive program.

Box built the original plow within a week after convincing I. D. (Slim) Wafer, Grand Isle district superintendent, that he had something worthwhile. Since then Box has enlarged and improved the device twice. The current model is built of ⅜-in. steel plate.

In operation, the plow follows about 20 ft. behind a lay barge. Pipe feeds through a roller box or "collar" at the top of the plow and settles neatly into the furrow.

A tugboat and two barges are used in pulling the plow across a bay. The tug is tied to a spud barge equipped with a crane and winch. A cable extends from the winch back to a lay barge where pipe is made up in three-joint sections.

The middle barge serves as an anchor, and the three vessels move across the water in a series of short steps. The tug pulls the spud barge forward a short distance while the lay barge remains still. Then the winch pulls the lay barge and plow forward as the pipe is lowered into the bay.

So far Box has left it up to the tide to cover pipe laid in this manner. However, he has developed a V-shaped double scoop to follow about 40 ft. behind the plow and pull mud back into the furrow.

Humble says the plow was designed for use in shallow water and probably wouldn't be practical for deep-water work in the Gulf of Mexico.

Although the plow can be used in digging up lines as well as laying them, it has certain limitations. It is difficult to follow old lines which are to be buried, and cross lines will interrupt normal operations.

The plow will readily dig through shale and mud, but it is not so effective in water with rocky bottoms or large tree stumps.

One of its greatest advantages is that the plow eliminates the need for divers to make sure a pipeline is resting in its trench.

Utah Bids Are High

Three-company group wins tract just south of Aneth

WINDOW ROCK, Ariz.—Aneth—the most significant Rocky Mountain strike in recent years—attracted $27,476,216 in lease money for 112,130 acres of Navajo Indian land in Utah and New Mexico.

High bidders at a recent sale here were Ohio Oil Co., Sun Oil Co., and Pure Oil Co., who combined to pay $3,102 per acre for a 3,560-acre tract in Utah, less than a mile south of the field. Total bonus for the tract was $7,941,120.

All the lands involved in the recent sale lie in the Four Corners area in the Paradox basin.

Second highest bonus bid was $2,100 an acre by The Texas Co. for tract 167, also immediately south of Aneth.

Other hot spot . . . Pure, Sun, and Ohio combined to purchase tract 158 for $1,653 per acre. This tract is about 8 miles east of Aneth, and less than a mile south of the new Texas Co. wildcat discovery, the 1-J Navajo.

Adjoining this lease to the south, The Texas Co. paid $1,003 per acre for 2,318 acres on the Colorado border.

Additional tracts were scheduled to be put on the block later this month, with 82,200 acres offered for sale November 13, and 158,505 acres November 23.

Five tracts totaling 11,482 acres were withdrawn from the recent sale. Titles to small portions of these tracts were not clear.

The sale was attended by 150 persons, with 35 firms submitting bids. The sale was the first on the Navajo Reservation within the Paradox basin since discovery of Aneth.

Aneth field is 5 miles long with only 12 development wells and 1 dry hole drilled to date *(The Oil and Gas Journal, October 29, page 170)*.

System Changes Hands

EDMONTON, Alta.—Rice Engineering & Operating, Ltd., has taken over operation of the big salt-water disposal system at Redwater field, 35 miles northeast of here.

The system, which was completed by Rice in 1953, serves 24 operators and more than 900 oil wells. Operating by gravity flow, it consists of seven disposal wells in the lower D-3 formation, some 66 miles of gathering lines, and 118 tank batteries. The installation was previously operated by Redwater Salt Water Disposal System.

Pipeline BRIEFS

The Texas Railroad Commission has approved Humble Oil & Refining Co.'s request to drop hand-gaging of oil and go to positive-displacement meters at its leases in Anahuac field of Chambers County on the Texas Gulf Coast. Humble was granted an exception to Statewide Rule 21 and Pipe Line Rule 9.

R. H. Fulton Co., Lubbock, Tex., has amended its application to the Wyoming Public Service Commission for authority to build a crude line to serve Donkey Creek field in northeastern Wyoming. Fulton now proposes to build a 39-mile, 6-in. line from the field southeast to the Osage pump station in Weston County. Fulton and Powder River Pipeline Co. recently filed competing applications for 18-mile lines east from Donkey Creek to Butte Pipeline Co.'s line.

Throughput of Trans Mountain Oil Pipe Line Co. the first 9 months of this year averaged 120,469 bbl. daily compared with 79,101 bbl. daily for the period during 1955. And new pumping stations, along with rising demand for Alberta crude in the Pacific Northwest, assure a continued sharp increase during the next year.

Capacity has been increased to 184,000 bbl. daily with installation of temporary stations at Gainford and Jasper, Alta. Completion of the Laurel, Wash., station, and permanent units at Jasper and Gainford will raise capacity to 200,000 bbl. daily by mid-1957.

Tennessee Gas Transmission Co., Houston, has received authority to operate 162 miles of main line and 13,940 compressor horsepower on its system between Louisiana and Massachusetts. The Federal Power Commission on June 28 granted temporary approval for the facilities, costing $20,337,940. The expansion increases Tennessee Gas' delivery capacity a maximum of 89,005,000 cu. ft. per day.

Holder Construction Co., Snyder, Tex., has the contract for 9 miles of 6-in. products pipeline from Tye, Tex., to the Onyx Refining Co. plant purchased recently by Cosden Petroleum Corp. The project will be completed this month.

Sheehan Pipe Line Construction Co., Tulsa, is taking up 75 miles of 8-in. products line in Pennsylvania and New Jersey for Sun Pipe Line Co. This line was replaced by 109 miles of 14-in. from Twin Oaks, Pa., to Newark, of which 90 miles was built by Sheehan and the remainder by Delaney-Missouri Valley Construction Co.

Pacific Gas & Electric Co. is building a $5,250,000 natural-gas pipeline linking the Beehive Bend gas field to the Sacramento area 83 miles south of the field. Contract for the pipeline was awarded to Engineers Limited Pipeline Co. The line will consist of an 18-in. for the first 37 miles and a 20-in. segment 37 miles long to a point east of Davis. From Davis, the line will be reduced to 16 in. into Sacramento.

Transcontinental Gas Pipe Line Corp. has received temporary Federal Power Commission approval to operate facilities increasing capacity of its system 49,000,000 cu. ft. per day. Facilities include 252 miles of pipeline being built under temporary authority and 12,750 hp. in compressor capacity. An additional 99 miles of pipeline also is proposed along the system from Louisiana to Pennsylvania.

Also for Pipeliners . . .

In one of the biggest deals in pipeline history, El Paso Natural acquired Pacific Northwest, which recently completed a 1,466-mile line from the San Juan basin to Washington State (P. 130) . . . Gulf will build a 10-in. natural gasoline and L. P. G. pipeline from West Texas to the Gulf Coast (P. 132) . . . Financing deadline for Trans-Canada pipeline has been extended from November 1 to December 1 (P. 133) . . . Humble has unveiled a new underwater plow that will dig a trench and thread pipe simultaneously (P. 134) . . . The FPC is scheduled to decide soon on two-company proposal to bring gas from Texas to Florida markets (P. 138) . . . Construction has started on a big-inch crude line from the Barinas-Apure basin in Venezuela's interior to Puerto Cabello on the Caribbean Coast (P. 142).

PLUS THESE TECHNICAL FEATURES: New mass flowmeter measures gas with spring-restrained turbine (P. 159) . . . Pipeline Patrol construction tables (P. 221).

New Squeeze Costs Less

Two years of research have resulted in new "dope" method for sealing tubing-coupling leaks in high-pressure wells

DALLAS.—A new technique for sealing off tubing-coupling leaks promises to save operators of medium-to-high pressure oil or gas wells lots of cash and headaches.

The method was developed over the past 2 years by Humble Oil & Refining Co. and Otis Engineering Corp. It is now being offered as a regular oil-field service by Otis Pressure Control, Inc.

The prime advantage of the technique is that it seals off thread leaks without the necessity of killing the well. Employing wire-line methods, it pares cost of sealing in a high-pressure well an average of $1,000 to $2,000.

Conventionally, on such a job, a rig large enough to accommodate two or three blowout preventers must be used to kill the well, pull packers and tubing.

Trouble often pops up during the process. Fishing jobs sometimes result. And costs can run up quickly to $40,000 or more, including mud expenses and those incurred for other services and equipment.

How it works . . . The new dope-squeeze process requires no expensive servicing equipment. A back-pressure valve, return-flow valve, and packoff stop (which permits pressure to be held on the tubing) are run down the tubing on a wire line through a lubricator on the christmas tree.

Alternate slugs of thread dope and water separated by wiper plugs are then pumped down the tubing so that each coupling is exposed to dope under pressure for about 30 minutes. A squeeze is held on the well for about 24 hours.

Surface equipment includes pump and dope container connected to the top of the christmas tree by several joints of pipe. For the approximate 20 wells treated so far, Otis has used joints of 2½-in. N-80 tubing for the dope container together with regular service-company pumping equipment.

It is difficult to throttle down a high-volume oil-field cement-pumping unit, however, to the needed slow, low-volume injections. And Otis is coming out soon with injection units designed solely for the dope-squeeze service.

Each unit will have a new 85-gal. reservoir or container, a low-pressure, screw-type pump to load the container, and a second low-pressure pump to shove the dope and water slugs down the tubing and maintain the desired pressure.

Its benefits . . . The technique's most appealing feature, of course, is its big savings of production-maintenance dollars.

Costs of dope-squeeze jobs on six wells ranging from 6,000 to 11,000 ft. deep—all either on the Gulf Coast or in East Texas—were $1,781; $238; $1,228; $1,800; $2,400; and $1,559.

It promises other benefits, too. The user would not be:

. . . **Exposing pay zone** to contamination by drilling mud.

. . . **Forced to undo** a good packer setup.

. . . **Wasting days or weeks** doing in the conventional manner what the new process accomplishes in a day or less.

. . . **Taking the chance** that a new leak may result from handling during the rerun part of a conventional tubing job.

The relative safety of the process is another point in its favor.

The application field for the method appears large. It, of course, would not generally be economically feasible for a shallow, pumping well with little bottom-hole pressure.

Its developers say it will fill the bill, however, wherever there is substantial pressure no matter what depth.

One of the prime reasons for pulling a production string from a well is to repair the tubing. In a large percentage of these cases, the threads are found to be the cause of communication between the tubing and the tubing-casing annulus.

This can be extremely hazardous, for instance, in a high-pressure gas well. A thread leak can cause corrosion and even rupture casing and collapse tubing if flow controls are used in the tubing to reduce surface pressure.

Thread leakage can result from: Improperly machined threads, damaged threads, improper makeup, foreign matter in threads, mashed collars, or expansion of collars due to temperature or pressure or both.

Osage Field Unitized

Flood, gas injection for West Little Chief planned

TULSA.—Operators in the West Little Chief field in nearby Osage County have formed a unit with Kewanee Oil Co. as operator and plan to undertake a combination water-flood and gas-injection project.

Unitization plans were cleared through the Osage Indian Agency and became effective November 1. Application now is before the Oklahoma Corporation Commission for approval of the secondary-recovery project.

The proposed unit covers 3,000 of the field's 4,000 acres. It contains 274 producing oil wells and 6 salt-water disposal wells. Production is from the Burbank sand at about 2,900 ft.

Field and plan . . . The field was discovered in 1953 and cumulative production by September 1956 totaled about 4,300,000 bbl. Engineers estimate ultimate recovery will be doubled by unitization plans. They put recoverable oil still underground at 35,000,000 bbl. Most of the wells still are flowing with a solution-gas drive.

Operators propose to inject water around the periphery of the field and return the produced gas into the center of the reservoir.

Kewanee holds a 27 per cent interest in the unit. Other interest holders are O. A. Shaw and associates, 20 per cent; A. G. Oliphant, 18; Sunray Mid-Continent Oil Co., 17; Norbla Oil Co., 9; The Texas Co., 8; and Yingling Oil Co., 2.

Refinery Sold

Pacific Petroleums buys plant from X-L Refineries

VANCOUVER, B. C. — Pacific Petroleums, Ltd., is expanding its facilities in northeastern British Columbia with the purchase of a 2,000-bbl. refinery at Dawson Creek.

The firm purchased from Excelsior Refineries, Ltd., and certain individual holders all the issued and outstanding common stock of X-L Refineries, Ltd., which operates the refinery. Pacific Petroleums early this year purchased a major interest in the refinery.

As part of the transaction, Pacific also acquired Excelsior's interest in some 40 retail outlets in the Peace River area, together with certain sales contracts.

Pacific Petroleums' expansion outlets in that area also include the $18,-million gas-processing plant at Taylor Flats, which is scheduled for completion in the fall of 1957—the first such plant in British Columbia *(The Oil and Gas Journal, April 30, page 91)*.

The Taylor Flats plant, located near Fort St. John on the north bank of Peace River, will process gas furnished by Westcoast Transmission Co. Westcoast Transmission will complete a big-inch pipeline from northern British Columbia to the U. S. border next year.

The plant will extract 250 to 300 tons of sulfur a day initially, in addition to removing all natural-gas liquids. It will also be designed to produce motor gasoline and aviation gasoline.

Depletion Changes Proposed

WASHINGTON. — Proposed new regulations covering the depletion allowance for oil and other natural resources were published by the Internal Revenue Service last week.

The bureau invited interested parties to submit their views on the proposed rules before December 3. Officials said a public hearing will be held, probably in January, before the regulations are made effective.

A number of changes are proposed. Two major changes involve the oil and gas industry.

One change deals with the tax treatment of separate properties and the possibilities for combining properties to secure the depletion allowance as a unit. The second deals with the option to expense or capitalize intangible drilling and development costs. There has been question in the recent past about extent of the option. The new regulations seek to clarify the definition of who has the right to deduct drilling costs.

watching WASHINGTON

. . . with Bertram F. Linz

Imports problem losing steam? . . .

FAST-MOVING events in the Middle East may put off the time when Mobilization Director Flemming has to decide whether oil imports threaten national security.

The importing companies' 1957 schedules filed with Flemming last week may turn out for a time to be just paper patterns. Unless the Suez Canal is reopened quickly and damaged plants and pipelines in other countries repaired, all the Middle East oil still available will have to go to Europe.

Unless the situation is cleared up by the end of the month, observers in Washington don't see how Flemming can keep his promise to make a decision by December 1.

But if Flemming doesn't have to make a decision on imports, he may have to make one on the building of tankers. New tankers couldn't be built in time to do any good in the present situation, of course. But it is likely that never again will the maritime nations place as much dependence on the Suez Canal as they have in the past. They may put steam behind the idea that the Government should give more than oral encouragement for a big building program.

If further action on imports is suspended it may be possible to work out a new start to keep them in proper relation to domestic production. Domestic producers are pointing to their slogan: "There is no security in foreign oil for the defense of our own borders." They are hopeful it will become the industry-wide view.

Heap big wampum . . .

NAVAJO Indian lands in the Four Corners area of Arizona, Utah, Colorado, and New Mexico are currently the hottest oil prospects in the country (see page 135).

The Interior Department this month took in close to $28,000,000 in bonuses for Navajo land. That was the highest total ever recorded for a single sale of Indian leases.

All the leases are close to the Ute Mountain Indian lands in southwestern Colorado which brought more than $7,600,000 in bonuses for leases on 53,000 acres last month.

These two sales alone brought in almost as much as was collected from all bonuses, rents, and royalties on Indian lands during the 12 months ended last June 30—$35,000,000 against $41,000,000. And two more sales are scheduled this week and next.

The forward look . . .

CONGRESS will take another look at the $33-billion road-building program next year. It isn't going to make any changes in the basic law. But some members want to get an idea of its future effects on the economy.

There is some basis for this concern. Only 40,000 miles of the planned 41,000-miles interstate network has been allocated. But bids for a share of the unallotted 1,000 miles already total some 12,000 miles.

First information to be sought will be how the states are coming along with their plans for new highways. A considerable number of contracts have been let since the program started last July 1 and several hundred miles of road are being started.

In its haste to get the program under way, Congress failed to take out insurance last session. It never was settled, for instance, whether there will be enough steel, cement, equipment, and manpower to keep the big job on schedule. And what the impact of the program will be on other segments of the economy with which it will compete for materials and manpower is another unanswered question.

Florida Gas Pondered

FPC decision on line from Texas expected by early 1957; two firms believe they have key to pry open new market

WASHINGTON.—A decision is nearing on a 1,527-mile pipeline from Texas to Florida to tap one of the nation's last major markets as yet unserved by natural gas.

The Federal Power Commission has resumed hearings on applications of Houston Texas Gas & Oil Corp., headed by F. E. Stanley, president of Midwestern Constructors, Inc., Tulsa, and Coastal Transmission Corp., a Clint Murchison company headed by W. J. Bowen. A decision is expected around the first of the year.

If the FPC approves the project, Houston and Coastal will have succeeded where other companies failed. Here's why:

. . . **They recognized** the Florida market as a real "sleeper" whose complexion has undergone a profound change in the past 10 years.

. . . **They found a way** to line up a big interruptible and industrial load, which is the key to feasibility of a major pipeline in sunny Florida.

User-producer contracts . . . The heart of the project, as outlined before the FPC, is an arrangement under which two utilities will buy gas directly from producers for their own use. The pipeline will merely collect a fee to transport it.

Florida Power & Light Co. has contracted for 100,000,000 cu. ft. daily from Sun Oil Co., Magnolia Petroleum Co., and La Gloria Oil & Gas Co. Some 800 billion cubic feet of reserves is involved. Florida Power Corp. has purchased 50,000,000 cu. ft. per day from Pure Oil Co. and Sun.

The price is pegged to Bunker "C" fuel oil. Gas is enough cheaper to make its use profitable, and will fluctuate with the price of fuel oil. At the level of fuel-oil prices when contracts were made, Florida Power & Light paid 18½ cents per M.c.f. in Texas. Florida Power Corp. paid 21½ cents in Louisiana for 1,000 B.t.u. gas.

Producers are receiving 16 to more than 18 cents per M.c.f. for gas bought by the pipelines for resale, depending on the location of reserves along the route. Total reserves committed to the project amount to 1,871,000,000,000 cu. ft. The volume dedicated will increase as development proceeds on dedicated leases. Negotiations are under way for substantial additional reserves.

The transportation gas going to the utilities directly will comprise more than half the initial deliveries through the pipeline.

Project development . . . The pipeline has been in the works for 2 years.

Before the Houston-Coastal project was organized, other companies had looked at the market and backed off. Those who actually tried to crack it failed because they couldn't get power-company commitments.

But Florida is not the same state it was 10 years ago. The face of this once predominantly resort state is fast being changed by new and expanding chemical, cement, paper, and citrus-fruit plants. Power companies are growing at rates ranging up to 15 per cent a year.

When a survey disclosed this great change, Houston and Coastal began to go after markets and reserves. The latter job was not easy. They ran up against reluctance to sell interstate gas by some producers because of uncertainties in federal regulation. There was also stiff competition from the big pipeline systems from the Gulf Coast to the Northeast which offered a ready market to producers.

The project reached the FPC last February, and by that time other pipelines were trying to get in on the act. Their petitions to intervene were thrown out.

Outlook reversed . . . In a few short years the outlook in Florida has changed completely. Instead of there being doubt as to the existence of a market capable of supporting a big-inch line, the sponsors now say the limiting factor is gas reserves.

Initial delivery capacity of the system will be 250,000,000 cu. ft. daily, with a peak of 275,000,000 cu. ft.

Houston officials said that existing customers could take more than 400,000,000 cu. ft. daily without another contract or new market being added.

Line details . . . Coastal plans a 566-mile, 24-in. line to cost $54,279,000 from McAllen, Tex., in the lower Rio Grande Valley, to Baton Rouge. There would be 272 miles of lateral lines.

Houston would build 961 miles of 24-in. from Baton Rouge to a point in Dade County near Miami for $94,742,500. Some 768 miles of laterals would be required.

As more gas becomes available, the system would be expanded. Capacity could be raised to a peak of 312,000,000 cu. ft. per day by adding 14,000 hp. in compression. Another 32,000 hp. would bring the line to its ultimate design capacity of 415,000,000 cu. ft. per day.

If the FPC approves the project in January, construction could begin in the spring. Houston officials said they had a "good" pipe commitment. Completion would be possible by the summer of 1958.

Refineries Expanding

D-X Sunray will build six units at Oklahoma plants

TULSA.—Sunray Mid-Continent Oil Co. is gearing for production of 100-octane gasoline at its Tulsa and Duncan refineries.

A $10-million expansion contract has been let to Refinery Engineering Co. of Tulsa for construction of six major units at the two Oklahoma plants. Completion is scheduled for the last quarter of next year.

The 67,500-bbl. Tulsa facility will get a:

. . . **20,000-bbl. U.O.P.** Unifining unit.

. . . **12,000-bbl. Platformer** with rerun column.

. . . **1,417-bbl. liquified petroleum** gas recovery unit.

. . . **2,453-bbl. butane - isomerization unit.**

. . . **2,470-bbl. HF alkylation** unit with debutanizer and rerun column.

The Duncan plant is scheduled for a 6,000-bbl. U.O.P. Unifining unit. Both refineries are operated by D-X Sunray Oil Co., a Sunray Mid-Continent subsidiary.

The buildup will increase catalytic reforming capacity at Tulsa to 19,500 bbl. and alkylation capacity to about 5,200 bbl. Cut out of the originally announced plans were a 12,000-bbl. hydrogenation unit at Tulsa and a 3,000-bbl. catalytic reforming unit at Duncan. The unifiner at Tulsa represents an addition.

R. W. McDowell, D-X Sunray president, said the expansion program is based on expectations of a continued rise in octane requirements during the next 4 years.

The company is now turning out 96 and 97-octane premium and 88 and 89-octane regular. McDowell said this meets current standards in the Midwest and middle south marketing areas of D-X stations, but added that the firm's premium will go to 100 octane by 1960, with regular climbing to 92 and 94.

ADJUSTABLE VENTS on Dow Chemical Co.'s barges have solved the low-bridge problem in transporting organic chemicals. Vents are shown, above, in horizontal position resting on arms.

Dow Barges Duck Low Bridges

FREEPORT, Tex.—Adjustable vents have solved Dow Chemical Co.'s problem of getting its new organic-chemicals barge under low bridges.

When necessary, the vents are lowered to the horizontal position to allow passage of the barge.

Dow says the hinged vents permit the new DC310 barge to pass under any bridge in the Texas division's waterway. The barge moves glycols, solvents, and other organic chemicals. In addition to interplant hauls, it serves customers along the Intracoastal Waterway.

The first barge designed and built specifically for movement of organic chemicals for the company's Texas division, the vessel has six cylindrical tanks with a capacity of 50,000 gal. each. Separate hookups and pumping systems permit a variety of chemicals to be moved at one time.

The tanks, being mounted in the barge hull, have in effect a double wall to insure against contamination.

The barge was built by St. Louis Shipbuilding & Steel Co. It is 225 ft. long, 37 ft. wide, and 11 ft. deep.

Dow Chemical announced that construction is under way on another special barge for handling caustic. To prevent corrosion, the tanks will be nickel-clad. Pipes, pumps, and valves also will be made of nickel.

Union's Shale Tests To Begin

DENVER.—Can Colorado shale be refined at costs competitive with crude oil?

This question may be answered "within 12 to 15 months" by Union Oil Co. of California at its new shale-oil plant near Grand Valley in western Colorado. The retort at Union's plant will have a capacity of 300 tons daily.

Addressing the nation's first Energy Resources Conference here last week, Dr. Fred L. Hartley of Union Oil said the firm expects to start shakedown tests next month "and should be producing some shale oil early in 1957." Hartley is vice president in charge of research for Union Oil.

The company is spending $7,000,000 to confirm the economic feasibility of refining oil shales on a large scale. The experiment might give the go-ahead signal for tapping Colorado's large deposits of commercial grade oil shale.

Hartley said Colorado has the world's largest known deposits of oil shale. He estimated that the reserves available to private industry total about 30 to 40 billion barrels of oil.

At the rate of production of 1 million barrels per day, Colorado's private oil-shale reserves would last 80 years without touching that half of the best shale still held as a government reserve.

The conference was attended by businessmen, educators, and researchers. Discussion ranged from atomic power to solar energy.

Processing BRIEFS

Fluor Corp., Ltd., is starting a new phase of operations. For the first time in its 66-year history, the engineering-construction firm will actively seek contracts for research in the petroleum, chemical, and petrochemical industries.

The emphasis will be on applied rather than basic research, enabling the 30 specialists in the research division, located in Whittier, Calif., to take advantage of the engineering talent from other operating units.

Imperial Oil, Ltd.'s new petrochemical center at Sarnia, Ont., may bring in Du Pont Co. of Canada as one of its first big customers for basic chemicals from petroleum. Du Pont reportedly has an option on 350 acres of Indian Reserve land on Lake St. Clair south of Sarnia.

The Lake St. Clair site is one of several locations Du Pont is considering for expanding Canadian operations. A likely beginning product for Du Pont would be polyethylene, which is enjoying a boom in Canada. If this operation is undertaken, the probable source of ethylene would be Imperial's $25-million project at Sarnia.

Du Pont Co. is considering an expansion of synthetic methanol expansion at Orange, Tex. Growing demand for antifreeze and other uses has resulted in resumption of methanol manufacture at Du Pont's Belle, W. Va. plant, where it originated. The capacity boost at Orange may amount to 30 million gal. per year.

Warren Petroleum Corp. has expanded its L.P.G. marketing activities to include the entire United States. Four regional sales managers were appointed to handle sales in the East, Northwest, Southwest, and Southeast. The company, with 14 district sales offices, becomes one of the few firms marketing L.P.G. in all 48 states.

A 40-ton-daily nitric-acid concentrator is under construction at the El Dorado, Ark., chemical plant of Lion Oil Co., a division of Monsanto Chemical Co. The unit will concentrate a 58 per cent solution to produce a nitric acid of either 68 or 95 per cent strength. Construction and design is by Chemical & Industrial Construction Co. Completion is scheduled for March 1957.

Leonard Refineries, Inc., is joining the color parade with a coloring program at its pumping stations, gathering stations, bulk stations, and three refineries. The company will use a red, white, and blue color scheme.

California Kills Bill

Conservation act is snowed under by a 3-to-1 majority; it's a dead issue now, but campaign effects will linger

LOS ANGELES.—Californians overwhelmingly rejected an oil and gas conservation act last week—the third time in 26 years.

Voters buried the proposal by more than a 3 to 1 landslide, but in some oil counties it was beaten as badly as 6 or 7 to 1.

Issue is dead . . . The lopsided vote appeared to kill any chances for conservation legislation soon. It is doubtful that a bill could be introduced in next year's legislative session. The next session, in 1958, is solely for budgetary legislation.

Without a marked change in attitudes, it is doubtful that any such bill could get approval of the legislature, anyhow.

During the campaign, sponsors of Proposition 4 explained they skipped the legislative process because they felt the influence of the anticonservation lobby in the legislature was too strong to overcome.

Charles S. Jones, president of Richfield Oil Corp., and a cosponsor of the measure, expressed his continued belief in the necessity for such a measure but, in a statement released after it was obviously headed for defeat, urged the whole industry to step up its voluntary unitization operations.

The main point in Jones' proposed act which split the industry so badly was that section which called for compulsory unitization of a pool where 75 per cent of the total working interest favored such a program. A three-man commission would have been set up to administer the law.

The consequences . . . Effects of the vicious battle will be felt within the industry for a long time.

The bitterness of the campaign was evident even down to the lowest echelons of the companies involved.

A veteran California oil man, who witnessed the state's two previous hassles over conservation bills, predicted that the breach in the industry would be apparent for at least 10 years.

Besides the effect within the business, oil men are alarmed over the reaction of the consuming public to the battle.

Operators of some service stations owned by major companies supporting the measure have complained that business has fallen off as much as 40 per cent in some cases.

Conversely, some independents who opposed the measure have seen a pickup in business. They attribute it to consumer distrust of the major companies as a result of charges hurled during the campaign.

If nothing else, the struggle certainly set a new record for the state in campaign expenditures. Before the final figures are in, it is expected that the total bill will approach $4,000,000.

Plant Makes "Tree" Rubber

AVON LAKE, Ohio. — Man-made rubber that reportedly duplicates natural rubber is being produced here at a pilot plant of Goodrich-Gulf Chemicals, Inc.

The plant is brand-new, but officials revealed that small quantities of the material, Ameripol SN, has been produced for more than a year while the facility was under construction. It will soon be made available to other companies for testing purposes.

Goodrich-Gulf said large truck tires manufactured with Ameripol SN are giving service comparable to those made with natural rubber, which was previously required for most satisfactory performance. The company said the new rubber has been found superior to standard truck tires in Army Ordnance tests.

B. F. Goodrich Co. believes Ameripol SN may also replace crude rubber as protective linings or coverings against chemical corrosion. Natural rubber currently has this field to itself.

Ameripol SN, which has the same molecular structure as crude rubber, was discovered in 1954 by Goodrich-Gulf scientists. Goodrich-Gulf is owned jointly by B. F. Goodrich Co. and Gulf Oil Corp.

Wildcat Hits in Deep Water

HOUSTON.—A gas-distillate discovery under 112 ft. of water in the Gulf of Mexico was reported last week by Continental Oil Co., operator for the C.A.T.C. Offshore Group.

The wildcat is in the deepest water ever tested by offshore operators.

Located in Block 43, Grand Isle area, the discovery is about 21 miles off the coast of Louisiana. It flowed 75 bbl. of 52.3°-gravity distillate and 1,287 M.c.f. of gas per day through ⅛-in. choke. Production is from the Miocene at 12,731-41 ft. The test was plugged back to 12,745 ft. from the original depth of 15,523 ft.

The well was spudded about June 1 and was drilled from a permanent-type platform supported by 260-ft. pilings *(The Oil and Gas Journal, June 4, page 64)*. A second well is now being drilled from the platform.

Flaring Quiz Set

Commission to investigate gas flaring in West Texas

AUSTIN.—The Texas Railroad Commission will quiz operators of two of West Texas' biggest fields this week on reported excess gas flaring in those fields.

The commission will take testimony November 14 on flaring in giant Slaughter field of Cochran, Terry, and Hockley counties.

On November 15, it will take up the flaring situation in the sprawling Spraberry Trend area and Spraberry Clearfork fields of Midland, Glasscock, Reagan, Upton, and Martin counties.

The commission said investigations by its engineering staff and reports filed by operators themselves indicate that gas flaring has exceeded the legal limits in these fields.

Clamped down in 1953 . . . This is not the first time Spraberry area operators have been in hot water for flaring. The commission clamped down hard in the spring of 1953 *(The Oil and Gas Journal, April 6, 1953, page 60)*. All wells and gasoline plants in the field which were venting or flaring gas were shut in.

They stayed that way for roughly 9 months until Permian Basin Pipe Line Co. laid a big-inch gas line into the area and all erring wells and plants were hooked up to it.

Since then, climbing gas-oil ratios of Spraberry wells hiked field gas production to the point where gasoline plants were unable to take all of it. The plants are reluctant to add to their capacity because of prospects that Spraberry gas production will last only a few more years.

Increased ratio in 1955 . . . The Railroad Commission in August of 1955 raised the permissible Spraberry gas-oil ratio to 4,000:1 on operators' testimony that this action, rather than hike field gas production, actually would cut it. This was due to the fact that the former 2,000:1 ratio had not been enforced and the average ratio over the field was well above 4,000:1.

Commission investigations indicate, however, that it hasn't worked out this way and Spraberry again is having flaring troubles.

Pattern of Costs: Up

For only 200 per cent more wells, industry had to spend 600 per cent more money in 1954 than 1939, census shows

WASHINGTON.—The oil and gas industry spent nearly six times as much money in 1954 to get less than twice as many producing wells as it brought in in 1939.

The industry drilled 22,560 wells in 1939, all but 3,703 of them producers. Total cost was $404,904,000.

In 1954, 52,210 wells were drilled and 16,357 of them turned out to be dry holes. These efforts cost $2,331,048,000, the Census Bureau said last week in a preliminary report on the 1954 census of minerals.

To get these wells, the industry drilled 207,841,000 ft. of hole in 1954. In 1939, the total footage was 72,191,000.

Number of wells . . . The 1954 census counted 426,089 producing and 29,088 shut-in oil wells, and 68,499 producing and 6,025 shut-in gas wells. Shipments of crude and field condensate amounted to 2,226,013,000 bbl. valued at $6,172,454,000. Gas production was 10,024,521 million cubic feet, of which 8,055,338 million cubic feet valued at $933,157,000 was shipped.

The 1939 census showed 300,179 producing and 12,834 shut-in oil wells and 47,466 producing and 4,850 shut-in gas wells. Shipments of crude and condensate totaled 1,228,933,000 bbl. valued at $1,253,084,000. Gas production was 2,929,185 million cubic feet and shipments were 2,287,413 million cubic feet valued at $115,350,000.

The average footage of upland wells drilled in 1954 was 3,981 and the average cost was $44,600 per well for an average of $11.22 per foot.

Offshore report . . . In offshore operations, reported for the first time, the wells averaged 8,940 ft. and the cost skyrocketed to $240,800 per well, an average of $30.85 per foot.

A total of 248 wells, 36 of them dry, were drilled in the Gulf of Mexico and off California in 1954, the census showed. Footage drilled was 2,217,000 ft. Cost was $68,385,000.

The deeper wells were off Louisiana and Mississippi. They averaged 9,721 ft. against 8,367 ft. off Texas and 7,328 ft. off California. The per-foot cost also was greater in the Mississippi-Louisiana area, $35.34 against $31.02 off Texas and $16.42 off California.

The burea's report said there were oil and gas operations in 36 states and Alaska in 1954. It noted, however, that there were no producing operations in six of these states or Alaska.

Texas accounted for 42 per cent of the total value of the oil produced and 52 per cent of the natural gas. California was second with 16 per cent of the oil, but had only 5 per cent of the gas. Louisiana accounted for nearly 11 per cent of the crude and 16 per cent of the gas.

Outside this "big 3," Oklahoma, Kansas, New Mexico, Wyoming, Illinois, and Colorado also shipped oil and gas in volumes returning each more than $100,000,000 in 1954.

Equipment, drilling costs . . . Cost of equipment for all types of producing wells, excluding offshore wells, totaled $259,409,000 in 1954, compared to $49,888,000 in 1939. Oil-well equipment cost $229,806,000 in 1954 and $47,849,000 in 1939.

For gas wells, the tab was $22,757,000 against $1,675,000 and for dry holes it was $3,486,000 against $364,000. Cost of service wells in 1954 was $3,360,000. There was no 1939 report on this one.

Money paid contractors for drilling or equipping wells amounted to $1,017,775,000 in 1954 and $147,981,000 in 1939. The break-down in this category reads: Oil wells, $578,746,000 in 1954 and $116,740,000 in 1939; gas wells, $105,778,000 and $8,560,000; and dry holes, $320,157,000 and $22,681,000. Service wells cost $13,094,000 in 1954.

Ratable Take of Gas Spreads

AUSTIN.—The Texas Railroad Commission acted last week to enforce ratable take of gas from Puckett Ellenburger field in Pecos County.

Puckett thus becomes the sixth Texas problem field where the commission has found it necessary during the past 15 months to junk the state-wide prorating system in favor of new rules.

The other fields are Henze, Blue Basin, Waskom, Alco-Mag, and the lower Pettet zone of big Carthage field.

New field rules call for:

. . . Percentage allowables. The commission will assign participation factors for all wells based on the field allocation formula. When the actual field production is known for a given month, the commission will multiply this by each well's factor to fix its allowable.

. . . Overproduction penalties. When a well overproduces its average monthly allowable, it will be shut in until its overproduction falls to less than its average allowable.

. . . Purchaser nominations to be used as a reasonable forecast of demand for gas from the field. Nominations for a given month must be filed by the twentieth of the preceding month.

. . . Pipeline buyer to assume responsibility for keeping wells in substantial production balance.

The new Puckett rules are essentially the same as those in force in Henze and Blue Basin.

The situation . . . The commission took its action after Atlantic Refining Co. complained it wasn't getting its fair share of the field's demand. The firm owns one of 13 wells in the field. Phillips Petroleum Co. owns the others.

Atlantic said its well could produce 22,000,000 cu. ft. daily with present tubing installation. Atlantic wanted to produce at or near this figure, but Permian Basin Pipe Line Co., the only buyer in the field, would take only a portion of this.

Phillips and Permian keyed opposition arguments to a processing plant, operated by Permian, which can process only 41,000,000 cu. ft. of gas daily. They argued that since Phillips owned the plant, Permian was buying gas at the plant tailgate, and that the plant was not an integral part of the field gathering system.

If Atlantic wanted to sell all its gas to the pipeline, they said, it should have to process it to make it acceptable to the line. The commission, however, ruled that Permian is a common purchaser in the field.

It also ruled that Atlantic should be permitted to make up accrued underproduction not cancelled as of November 1. This will permit Atlantic to produce about 467,000,000 cu. ft. over its allowable at the expense of Phillips wells which were overproducing during the same period.

State-federal conflict . . . The Puckett spat appears to be another clear-cut conflict between the state's field-proration formula and 20-year reserves contracts required by the Federal Power Commission.

Permian had such a contract with Phillips. But with the commission ruling, it's doubtful that Permian will be able to take its full contract volume from Phillips. Capacity of the processing plant is not high enough.

Barinas Line Started

● Williams Brothers building important crude outlet for Socony, Sinclair discoveries in the Venezuelan interior

WORK has begun on a 212.5-mile, 20-in. crude pipeline which will open up the Barinas-Apure basin, destined to become Venezuela's third major producing area.

Williams Brothers was awarded the contract to build the line for Socony Mobil Oil Co. de Venezuela. Sinclair Oil & Refining Co. will be part owner.

The line, engineered by Magnolia Petroleum Co., a Socony affiliate, will cost $25,000,000. It will extend from San Silvestre field, southeast of the city of Barinas, northwestward to Puerto Cabello on the Caribbean Coast. It will be the longest big-inch line ever laid in Venezuela.

Right-of-way is already being cleared. Pipe laying will begin sometime during the last 2 weeks of December and completion is scheduled for next July.

Pump station, capacity . . . A single pump station will be built at Silvestre.

Three 2,000-hp. diesel centrifugal pump units will develop 1,200 psi., giving the line an initial capacity of 110,000 bbl. per day. This station contract has not been let.

An intermediate station, at Acarigua near the mid-point of the line, is a possibility later. It would increase capacity from 165,000 to 170,000 bbl. per day.

Sinclair and Socony have around 12 to 15 shut-in wells each. These flowing wells could provide an initial throughput of 60,000 bbl. daily and development is continuing.

Four 150,000-bbl. floating roof tanks will be built near the station. Power for producing operations and auxiliary station equipment will be supplied by two 2,000-kw. generators.

Pipeline construction . . . Pipeline construction will be under the direction of Edwin Hubach, general manager for Williams Brothers in Venezuela. James T. Childress is project superintendent.

The contractor will have a single spread plus a double-jointing crew working ahead of the spread pipe gang, a technique which can speed pipe laying 35 to 40 per cent. Some 350 to 400 workers will be employed.

The line will be laid on concrete blocks 1 ft. above ground and left bare, except for river and road crossings where pipe will be coated and wrapped. It will be protected by magnesium anodes.

The line will traverse a variety of terrain, from jungle, to rice-growing plains, to mountains. The rainy season will pose the biggest construction problem. For 80 miles from the lower end, rainfall averages 100 in. during the rainy season which runs from mid-April to December. The water table is plus 5 in. during this time and falls to only minus 5 in. in the dry season.

To avoid lost time in moving, the contractor will maintain two camps of collapsible aluminum buildings. One will house the spread while the other is being set up at the next location.

River crossings . . . The line will cross 12 major streams, making about 3 miles of this type of construction.

To prevent scouring damage during floods, pipe will be buried several feet below the river beds. A cut of 44 ft. in the banks will be necessary in some instances to assure burial at a safe depth. And in all cases pipe will be at least 10 ft. below the main river bed. The long approaches to the rivers will mean that there will be no bends in the pipe.

This phase of the job will have to be completed before the next rainy season sets in.

Terminal . . . A tanker terminal capable of handling the largest supertankers will be built at Puerto Cabello.

Chicago Bridge & Iron has the contract to erect five 260,000-bbl. tanks, from which a supertanker (capacity 225,000 bbl.) could load at the rate of 25,000 bbl. per hour.

A 30-in. line will be laid from the tanks to a dock 2,300 ft. long, to be built at the end of a rock fill extending 1,200 ft. from shore. Tankers will load in water 60 ft. deep from a 24-in. line on the dock. The dock and loading lines will be built by J. Rich Speers and Morrison-Knudsen Co., Inc.

Launching Preludes "Super" Series

B. R. JACKSON, chairman of British Petroleum Co., Ltd., used the launching of "British Industry," first in a series of new 32,000-ton tankers, to announce B.P. will build others almost twice that size.

Jackson said BP Tanker Co. is including tankers of 60,000 tons in its next building program. The company now has 144 ships totaling 2,018,000 tons, but the largest is 32,000 tons. Forty-one more tankers are either building or on order for B.P., including seven 42,000 tonners.

The "British Industry" was christened by Lady Kirkpatrick, wife of Sir Ivone Kirkpatrick, permanent undersecretary of state in Britain's foreign office. The vessel was launched at the Clydebank yards of John Brown & Co.

Nahorkatiya Up Again

India field reserves now set at 365,000,000 bbl.; new appraisal represents third sharp increase in 6 months

NAHORKATIYA field in northern India can produce 50,000 bbl. of crude daily for the next 20 years on the basis of a new appraisal of the field's proved reserves.

This represents the third sharp increase in the field's estimated potential in less than 6 months.

W. B. Metre, senior geologist of Assam Oil Co., which is developing the field, cited the newest figures in an address at the thirty-second annual meeting of the Geological, Mining, and Metallurgical Society of India in Calcutta.

He said Nahorkatiya's proved reserves are now large enough that India can count on production of 2,500,000 tons of crude a year (about 50,000 bbl. daily) and 45,000,000 cu. ft. of gas daily. Metre said the gas production is equivalent to almost 12,000 bbl. daily of fuel for consumption in India.

Digboi declining . . . The Assam Oil geologist said production of Digboi field, India's oldtime producer, can be expected to decline to an average of 6,000 bbl. daily over the next few years.

Digboi production, plus the 50,000 bbl. daily which Nahorkatiya's 19 wells can produce, would furnish 56 per cent of India's crude requirements. Indian production from Digboi only accounts for about 8 per cent of the country's consumption today, Metre revealed.

Early in September, A.O.C. said Nahorkatiya's field could produce 40,000 bbl. daily for the next 20 years, indicating a proved reserve of more than 300,000,000 bbl.

The September estimate doubled one of 20,000 bbl. daily potential made earlier *(The Oil and Gas Journal, July 23, page 74)*.

Metre's estimate of the field's productive potential would indicate proved reserves in excess of 365,000,000 bbl.

Metre emphasized that his estimates of Upper Assam's productive potential from both the old and new fields do not include production in the Hugrijan area near Naholia and in the Moran area where his company is optimistic about its wildcatting program.

Refinery question . . . The Indian Government and Assam Oil only recently reached an agreement on the participation each will have in the development of Nahorkatiya's oil.

After months of negotiation it was agreed that A.O.C., a subsidiary of Burmah Oil Co., Ltd., will have a two-thirds interest in the production and the government the remaining one-third *(The Oil and Gas Journal, September 3, page 87)*.

One still-unanswered question dulls the rosy hue of Metre's production estimates. It concerns a refinery to process Nahorkatiya crude so it can be used in India.

The company and the government reportedly have agreed that the government will have a "substantial majority" in a refining company to process the crude. The refinery location is still a hurdle. A.O.C. wants to build a refinery at Calcutta, where it claims an installation would have the greatest economic advantage. The government is insisting on a refinery in Upper Assam, near the production.

The Digboi refinery has a capacity of 5,900 bbl. daily, but is operating at less than capacity now because of a lack of demand in Upper Assam and no adequate method of moving the refinery's output to other areas of the country.

Saar Awards Made

Grants go to four German firms; wildcats find oil

FOUR West German companies have obtained concessions over promising exploration areas in the Saar, where oil traces have been appearing for several years in some coal mines.

The companies are Deutsche Erdoel-A.G., Deutsche Schachtbau-und Tiefbohrgesellschaft m.b.H., Mobil Oil A.G., and Wintershall A.G.

Two wildcats hit . . . Meanwhile exploration drilling in widely separated parts of West Germany has paid off in two recent tests.

A discovery in the Upper Rhine, 15 miles north of Karlsruhe, was made by Wintershall A.G. and C. Deilmann Bergbau, G.m.b.H. The 1 Huttenheim flowed 31°-gravity crude at the rate of 157 bbl. daily through a 1/5-in. choke.

The 1 Ortland, drilled by Mobil Oil and Gewerkschaft Brigitta, 2 miles east of Quakenbruck in the northwestern part of the country, had an initial flow of 95 bbl. daily of 32°-gravity crude through a ⅛-in. choke. Final depth of the hole was 5,337 ft. The flow came after fracturing from 1,748-1,801 ft.

Plant Stocking Up

Rebuilding Burma refinery lays in first crude cargo

THE first 13,000 bbl. of Burma crude from Chauk field has been barged to a newly rebuilt storage at the Syriam refinery near Rangoon.

Before the rebuilt refinery goes on stream early next year, Burmah Oil Co. (1954) plans to have 135,000 bbl. of crude on hand. The refinery once processed Burma's prewar production of about 21,000 bbl. daily.

Only a fraction of this prewar capacity is being rebuilt, but Syriam's 3,500-bbl. distillation unit, plus a topping plant at Chauk field, will handle Burma's domestic consumption.

The Syriam plant was destroyed by the British in their retreat from Burma in World War II. It is being rebuilt by Foster Wheeler, Inc., under contract with the B.O.C. - government owned company. The Burmese Government has a one-third interest in Burmah Oil Co. (1954) and the remaining two-thirds is held by Burmah Oil Co., Ltd.

As soon as the refinery goes on stream, about 4,000 bbl. daily of Chauk field production will be moved to the refinery in barge trains pushed by tugs.

Relief Well Plans Halted

Plans for a relief well to control Iran's giant wildcat near Qum have been halted temporarily because of Middle East disturbances.

Eastman International Co. of Denver has charge of plans for drilling a diagonal relief shaft, which would either seal off the original well or divert enough pressure that it can be controlled. Eastman has moved a rig from another part of Iran to the scene and has gathered necessary additional equipment in the U. S. for the job. It will be shipped as soon as the present crisis is ended.

The well was capped in August by Myron Kinley, internationally known Houston oil trouble shooter. It had spewed crude over the countryside at the rate of 100,000 bbl. daily for several weeks. The oil was accompanied by about 200,000,000 cu. ft. of gas daily. In September Iranian National Oil Co. warned the cap was leaking and threatening to blow.

Oil's Outlook in '57...and beyond

by John C. Casper
Economics Editor

Big things are in store for oil in 1957. What happens then also will shape trends for the next 5 years, and even longer.

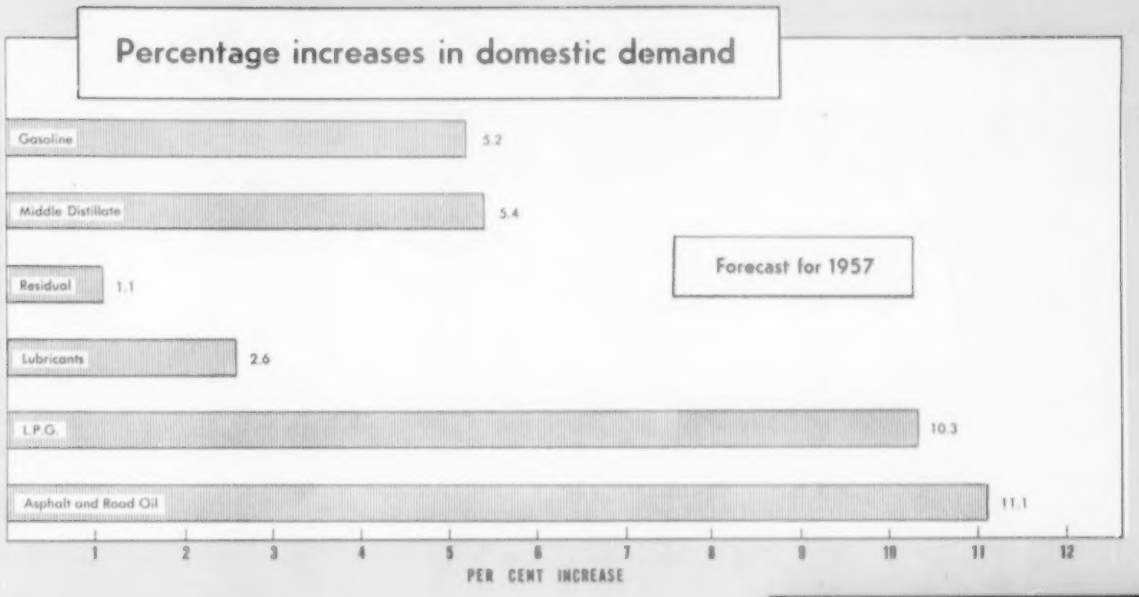
Oil industry leaders charged with making long-range decisions must be familiar with these statistics and trends. Others in less exalted positions likewise must know which way the wind is blowing to make their own plans.

Basic questions, for instance, arising: How much crude will we be able to sell in 1957? or 1961? . . . How many wildcats should we project over the next 5 years? . . . Shall we expand our basic refining capacity? Or should we concentrate on upgrading our products? . . . Will there be a need for more big-inch gas lines? Where?

Answers, naturally, lie in the future. But much already is known. Much more can be determined so the answers can be anticipated with reasonable accuracy.

The Journal, as a guide to your company planning, presents on the next 8 pages its forecasts of:

- Supply and demand in 1957
- Supply and demand through 1961
- Factors shaping long-range trends
- Drilling through '56 and the next 5 years
- Refining for the next 5 years
- Pipelining for the next 5 years



Mark up 1957 as . . .

. . . Another Record Year

DOMESTIC demand for petroleum products will continue its upward trend in 1957 but at slightly slower pace than in 1956. Both volumetric and percentage gains will be less than the large increases recorded this year.

Required increases in total supply next year will be less than the gains forecast for demand. This means that less of the over-all supply will go to inventories in 1957 than in 1956.

Here are some of the highlights of the forecast for the coming year:

. . . **Total domestic demand** will be up 5.1 per cent.

. . . **Exports** will decrease 4.8 per cent.

. . . **Total demand** will gain 4.8 per cent.

. . . **Total demand** will top 10,400,000 bbl. daily in the fourth quarter of 1957.

. . . **Total supply** will reach 10,000,000 bbl. daily for the first time in the last quarter of next year.

. . . **The largest percentage gain** for the year will be in jet fuel, estimated at 22.7 per cent.

. . . **The biggest volumetric gain** will be in the demand for gasoline, up 197,000 bbl. daily.

. . . **Daily average increases** will be at a peak in the third quarter, 534,000 bbl. daily over the same quarter of 1956.

. . . **Additions to stocks** for the year will be 81,000 bbl. daily less than for 1956.

. . . **New supply** will gain 3.9 per cent in 1957.

. . . **Gains in imports** will absorb almost one-third of the total increase in new supply.

. . . **Refinery runs** will be up about 4.1 per cent.

Increases in demand for the coming year are related to forecasts of gains in the over-all economy. Total industrial production this year is expected to average about 142 as measured by the industrial index of the Federal Reserve Board. The average for 1957 is forecast at 147.

The value of all goods and services this year seems to be headed for a total of about 409 billions of dollars. Measured in 1956 dollars, the total for next year is forecast at about 421 billions, for a gain of almost 3 per cent. Continuing mild inflation may produce a total of 427 billions, measured in 1957 dollars.

In general, oil-industry economists expect the upward swing of the business cycle to continue through at least the first half of 1957. The turn toward slightly less favorable conditions for the last half of the year is not expected to be severe.

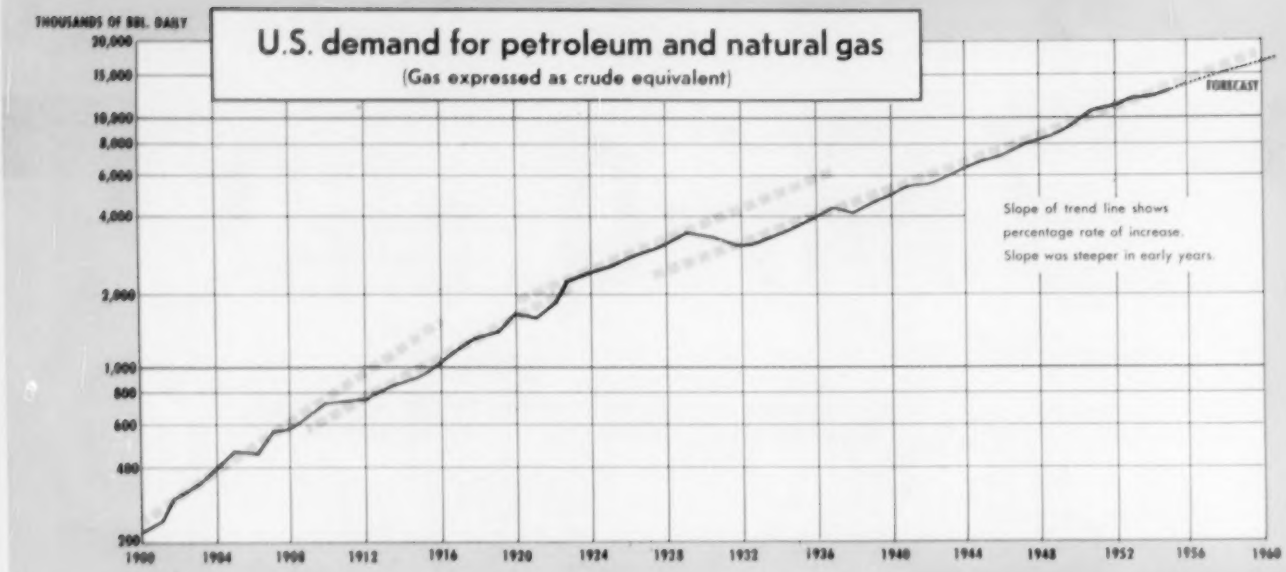
Demand . . . The 5.2 per cent gain in domestic demand for gasoline next year is based on projected sales of about 6,500,000 cars in 1957.

Road construction under the long-term federal program will not be far enough along by the end of 1957 to act as an incentive for increased driving. But the work itself will add to the demand for diesel fuel and gasoline as well as asphalt.

Forecasts of demand for middle distillates assume near normal weather. Cold weather lasted longer than normal last spring to produce unusual demands for distillate fuels in the second quarter. The 19.7 per cent gain for the second quarter of 1956 is an important factor in the small increase of 3.4 per cent forecast for the same quarter next year.

Domestic demand for distillate will exceed 2,500,000 bbl. daily for the first quarter of next year and is expected to average almost 1,850,000 bbl. daily for the year. This level will represent an increase of 6.5 per cent over the total for 1956.

Details of the forecast for asphalt and road oils are shown in the big table



because of the interest in these products under the new road program.

The forecast calls for a first-quarter increase that is only slightly larger than normal since highway use of these products is confined to the summer months for most of the country. Demand may reach almost 500,000 bbl. daily in the third quarter, and continuing work in some of the southern states will result in good gains for the fourth quarter.

In general, more oil company economists are in agreement on the probable demand for next year than on the question of how these demands will be met.

In the first place, the 444,000-bbl. increase in total demand next year can be met with a gain of 363,000 bbl. daily in new supply. This means that less of the new supply next year will go to increased inventories.

The 1956 average for additions to stocks is estimated at 110,000 bbl. daily or a total of a little more than 40,000,000 bbl. Considering the high level of inventories expected for the end of this year, the industry probably could get along without any additions next year. However, in the process of balancing product stocks the net effect will be a gain in total inventories. The total for the year is forecast at almost 10,000,000 bbl. for the year or 29,000 bbl. daily.

Supply . . . If there were no increase in total demand in 1957, required supply would be about 81,000 bbl. daily less than actual in 1956. Also, smaller addition to inventories accounts for the fact that a 4.8 per cent increase in demand can be met with a gain of 3.9 per cent in supply.

Most of the correction should be made in gasoline stocks. At the end of October this year total gasoline stocks were showing an increase of about 20,000,000 bbl. over last year. It is estimated that about 1,500,000 of this excess can be corrected before the end of this year, leaving a year-end total of 184,000,000 bbl. compared with 165,400,000 bbl. at the close of 1955.

If another 3,000,000 bbl. can be trimmed from gasoline stocks during 1957, closing stocks of 181,000,000 bbl. would represent a 2-year gain of 15,600,000 bbl. or 9.4 per cent. This gain will be more normal than the jump of 11.2 per cent for the single year 1956.

World conditions are so unsettled at this time that it is necessary to make certain assumptions before consistent estimates of supply for 1957 can be established.

If the Suez Canal is closed for a long period of time, demand for crude from this country will increase by as much as 400,000 to 500,000 bbl. daily. If other Middle East production schedules are disrupted by the unsettled conditions in the area, over-all crude imports by refiners in this country would drop. Crude and product exports would increase unless restricted by an embargo.

If the Suez Canal is opened to traffic, crude imports into this country are scheduled to increase in 1957.

The supply data in the table are more in the nature of a suggested balance than a positive forecast. Production and import totals are based on these assumptions:

. . . Diversion of traffic from the Suez Canal will be ended before the end of the year.

. . . Transportation for Middle East crude will be available throughout the year.

. . . Imports will not be restricted by the Government at least for the major portion of 1957. The 5-year forecast allows for some restriction, either voluntary or by law, starting sometime in 1958.

Under the above assumptions, imports next year will account for about one-third of the total increase in new supply.

Domestic demand totals represent firm forecasts, but changes in world conditions can bring major changes in imports, exports, and domestic production. To the extent that any of the supply items vary from the projected totals, other supply sources will change but in the opposite direction. If imports are down, domestic production will be up.

A Preview of 1957 Supply and Demand

(Thousands of barrels daily)

	First quarter		Second quarter		Third quarter		Fourth quarter		Year 1957	
	Volume	Per cent change	Volume	Per cent change	Volume	Per cent change	Volume	Per cent change	Volume	Per cent change
GASOLINE DEMAND:										
Total	**3,670**	**4.7**	**4,285**	**4.7**	**4,295**	**5.8**	**4,055**	**4.5**	**4,078**	**5.0**
Export	80	1.3	85	— 2.3	85	—11.5	85	5.6	84	— 4.5
Domestic	3,590	4.8	4,200	4.8	4,210	6.2	3,970	4.7	3,994	5.2
KEROSINE:										
Total	**486**	**1.0**	**200**	**— 0.5**	**217**	**— 6.5**	**466**	**2.2**	**342**	**— 0.3**
Export	6	50.0	5	—44.4	5	—37.5	6		6	—14.3
Domestic	480	0.6	195	1.6	212	—5.4	460	2.2	336	
DISTILLATE:										
Total	**2,600**	**5.7**	**1,410**	**3.1**	**1,295**	**6.8**	**2,340**	**8.1**	**1,909**	**6.0**
Export	50	—13.8	65	— 3.0	70		60	— 7.7	61	— 6.2
Domestic	2,550	6.2	1,345	3.4	1,225	7.3	2,280	8.6	1,848	6.5
RESIDUAL:										
Total	**1,925**	**2.0**	**1,525**	**1.5**	**1,430**	**3.0**	**1,805**	**— 1.8**	**1,670**	**1.0**
Export	65	14.0	65	—14.5	70	— 4.1	65	— 5.8	66	— 2.9
Domestic	1,860	1.6	1,460	2.3	1,360	3.3	1,740	— 1.7	1,604	1.1
JET FUEL:										
Total	**212**	**34.2**	**220**	**19.6**	**235**	**19.3**	**240**	**20.0**	**227**	**22.7**
Export										
Domestic	212	34.2	220	19.6	235	19.3	240	20.0	227	22.7
LUBRICANTS:										
Total	**151**	**0.7**	**158**	**— 5.4**	**163**	**7.2**	**160**		**158**	**0.6**
Export	35	— 2.8	38	— 9.5	40	— 4.8	40		38	— 5.0
Domestic	116	1.8	120	— 4.0	123	11.8	120		120	2.6
L.P.G.:										
Total	**557**	**9.0**	**420**	**10.5**	**440**	**11.7**	**590**	**8.9**	**502**	**9.8**
Export	12	— 7.7	10		10	—16.7	10	—16.7	11	— 8.3
Domestic	545	9.4	410	10.8	430	12.6	580	9.4	491	10.3
ASPHALT AND ROAD OIL:										
Total	**142**	**7.6**	**339**	**10.8**	**500**	**11.4**	**240**	**11.6**	**306**	**10.9**
Export	4	—20.0	4	33.3	5	—16.7	5		5	
Domestic	138	8.7	335	10.6	495	11.7	235	11.9	301	11.1
OTHER PRODUCTS:										
Total	**416**	**3.7**	**460**	**2.9**	**500**	**4.8**	**460**	**4.5**	**459**	**4.1**
Export	16	— 5.9	20	— 4.8	20	5.3	20	11.1	19	
Domestic	400	4.1	440	3.3	480	4.8	440	4.3	440	4.3
CRUDE:										
Total	**60**	**—21.1**	**60**	**—22.0**	**60**	**— 1.6**	**60**		**60**	**—11.8**
Export	25	—13.8	25	—16.7	25		25		25	— 7.4
Loss	35	—25.5	35	—25.5	35	— 2.8	35		35	—14.6
ALL OILS:										
Total	**10,219**	**4.7**	**9,077**	**4.0**	**9,135**	**5.9**	**10,416**	**4.6**	**9,711**	**4.8**
Export	293	— 1.7	317	— 8.1	330	— 6.0	316	— 4.2	315	— 4.8
Domestic	9,926	4.9	8,760	4.5	8,805	6.5	10,100	4.9	9,396	5.1
STOCK CHANGE:										
Total	**—389**		**433**		**485**		**—416**		**29**	
Crude	— 34		16		16		— 14		— 4	
Products	—355		417		469		—402		33	
NEW SUPPLY:										
Total	**9,830**	**4.0**	**9,510**	**2.8**	**9,620**	**3.4**	**10,000**	**5.3**	**9,740**	**3.9**
PRODUCTION:										
Total	**8,160**	**1.6**	**8,010**	**1.8**	**8,120**	**3.2**	**8,300**	**5.7**	**8,148**	**3.1**
Crude	7,300	1.0	7,200	1.4	7,300	2.9	7,400	5.3	7,300	2.6
Natural, etc.	860	7.0	810	5.9	820	5.9	900	9.8	848	7.2
IMPORTS:										
Total	**1,670**	**17.4**	**1,500**	**8.5**	**1,500**	**4.4**	**1,700**	**3.0**	**1,592**	**8.1**
Crude	1,050	21.8	1,030	12.8	1,050	1.4	1,070	1.9	1,050	8.8
Products	620	10.7	470	0.2	450	11.9	630	5.0	542	6.7
RUNS TO STILLS	**8,300**	**3.8**	**8,130**	**4.0**	**8,250**	**3.1**	**8,400**	**5.3**	**8,270**	**4.1**
STOCKS:*										
Total	**720.1**		**759.5**		**804.1**		**765.8**		**765.8**	
Gasoline	209.0		182.5		171.0		181.0		181.0	
Kerosine	16.6		27.0		34.4		26.4		26.4	
Distillate	63.8		100.3		153.0		120.0		120.0	
Residual	38.0		42.5		48.0		44.0		44.0	
Other products	116.0		129.0		118.0		116.0		116.0	
Crude	276.7		278.2		279.7		278.4		278.4	

*Millions of barrels.

Demand Trends

Supply Trends

	Liquids			Natural Gas Consumption and Loss*	Per Cent Gain, Domestic Demand		Domestic Production	Total Imports	Total New Supply	Total Stock Change	Refinery Runs
	Domestic Demand	Export Demand	Total Demand								
1947	5,452	450	5,902	2,579	11.0	1947	5,452	436	5,888	—14	5,075
1948	5,775	368	6,143	2,718	5.9	1948	5,922	514	6,436	293	5,549
1949	5,803	327	6,130	2,864	0.5	1949	5,477	646	6,123	—7	5,327
1950	6,507	305	6,812	3,234	12.1	1950	5,906	850	6,756	—56	5,739
1951	7,053	422	7,475	3,767	8.4	1951	6,720	844	7,564	89	6,494
1952	7,280	432	7,712	4,036	3.2	1952	6,868	952	7,820	108	6,670
1953	7,604	401	8,005	4,204	4.5	1953	7,113	1,034	8,147	142	7,000
1954	7,760	355	8,115	4,322	2.1	1954	7,035	1,052	8,087	—29	6,958
1955	8,415	365	8,780	4,625	9.7	1955	7,532	1,248	8,780		7,480
1956	8,936	331	9,267	4,860	6.2	1956	7,904	1,473	9,377	110	7,948
	Forecast						Forecast				
1957	9,396	315	9,711	5,120	5.1	1957	8,148	1,592	9,740	29	8,270
1958	9,670	310	9,980	5,340	4.2	1958	8,490	1,540	10,030	50	8,532
1959	10,060	300	10,360	5,590	4.0	1959	8,800	1,600	10,400	40	8,837
1960	10,450	290	10,740	5,820	3.9	1960	9,120	1,670	10,790	50	9,147
1961	10,860	290	11,150	6,050	3.9	1961	9,450	1,740	11,190	40	9,472

*Expressed as crude equivalent in thousands of barrels daily. (6,000 cu. ft. of gas equals 1 bbl. of crude.)

The long-range picture:

. . . Up—But at a Lower Rate

Supply-Demand

THE nation's demand for petroleum products in the next 5 years will show a steady increase. But the more spectacular gains recorded in the postwar years will be lacking.

These requirements will continue to increase at an average rate of 4.0 per cent over the 5-year span. In 1961 domestic demand will total 10,860,000 bbl. daily and natural gas 6,050,000 bbl. daily. Exports will be off to 290,000 bbl. daily.

This is a far cry from the 1947-56 years. Annual gains then averaged 5.6 per cent. Even more sensational jumps were made in some of those years. In 1947, demand shot up 11 per cent. It increased 12.1 per cent in 1950, and even in 1955 a 9.7 per cent rise was experienced.

Why then is demand leveling off?

There are two major explanations:

. . . Accumulated demand built up during war years. Some of the early postwar gains in demand resulted from attempts to meet this pent-up potential. Actual fulfillment of these demands was spread over several years. Producing and processing capacities had to be expanded gradually after the war.

. . . Replacement of other energy fuels by petroleum. This shift in fuel patterns occurred rapidly after the war. It also shows signs now of tapering off in the coming years.

Cinderella fuel . . . Oil has come a long way in the nation's fuel picture since 1920.

In that year the per capita consumption of petroleum products and natural gas amounted to the equivalent of 200 gal. a year. At the same time, per capita consumption of other energy fuels and water power was the equivalent of 1,107 gal. of petroleum products per year.

The picture was reversed by 1955. Consumption of gas and petroleum had risen to 1,162 gal. per year. Use of other fuels had dropped to 579 gal. per year. This means that demand for oil and gas expanded nearly five times on a per capita basis since 1920. This trend is emphasized when population growth is considered also. At the same time per capita demand for other fuels dropped to about half its 1920 volume.

Oil and gas consumption came into its own in 1948. That was the year petroleum use exceeded all other energy fuels for the first time. But petroleum showed interesting strength in its upward climb. It weathered the big depression and smaller dips in the nation's economy better than other fuels.

For instance, the saucer-like depression in the curve on Chart 3 shows a decrease in use of oil and gas starting in 1930. It is very shallow, however, compared with the straight-line drop for other fuels during the 1929-32 period. This is still true. Conditions that produced a leveling-out of petroleum demand in 1954 caused a very sharp drop in use of other fuels.

More people, more oil . . . The average citizen during the 1920-55 period increased his consumption of all energy fuels by 0.8 per cent a year. In addition to this per capita increase, there was a general increase in population averaging about 1.3 per cent a year.

But the per capita consumption of petroleum and natural gas jumped at the rate of 4.7 per cent a year for the same period. Use of other energy fuels showed an average decline of 1.8 per cent a year during that time.

When these two trends are compared, it is evident that some of the gain in use of oil and gas came through replacing other fuels. Not enough information is available to tell just which fuel replaced another.

Consumption of other energy fuels has shown a rather steady decline since about 1943—midway in the war.

But demand for the other fuels is not expected to continue this downward trend at the same rate prevailing in recent years. Per capita consumption of these fuels in 1950 was equivalent to 741 gal. of petroleum products. By 1955 it had dropped to 579 gal.

If this same rate of decline were projected for the next 6 years, the average for 1961 would be down to the equivalent of 356 gal. of petroleum. It is not expected to sink that low.

What's after 1961 . . . Petroleum demand is forecast only through 1961.

Domestic demand for that year is expected to average 10,860,000 bbl. daily compared with 8,415,000 bbl. daily in 1955. Export demand will follow the declining trend that has existed since the end of the war. Thus total demand, including exports, for 1961 is placed at 11,150,000 bbl. daily.

Several imponderable factors will influence demand after 1961. These include:

. . . **Changes in population** trends in this country.

. . . **Changes in transportation** methods.

. . . **Growth of atomic** and solar energy, especially use of chemical reactions as a basis for storing solar energy.

. . . **New ways of heating homes.**

. . . **Expanded use of automation.**

The varying interplay of all these factors makes forecasting demand past 1961 a hazardous undertaking. But what is known about their economic effects points to continued heavy use of petroleum.

Teenagers important . . . Economists know that increases in population in this country influence demand for products of all kinds. But they influence different products at varying periods from the time of the population rise.

Naturally, demands for food and baby clothing increase immediately. The flood hits our school systems in 5 of 6 years and colleges in about 18 years. And the big tide is felt in motor-fuel sales in about 16 years.

In many states the current crop of teenagers, born in 1940, became automobile drivers this year. Any father with a teenage driver in the family knows what a boost that driver's license means to the mileage on the family car.

The years 1941, 1942, and 1943 experienced sharp increases in population. That period was followed by 3 declining years until the end of World War II. Other factors being equal, we can expect better increases in gasoline demand over the next 3 years than for the 3-year period that follows.

The big jump in population came in 1947 just after the end of the war. By that token, look for outstanding increases in motor-fuel demand starting about 1963. The term motor fuel is used because of the uncertainty of the type of fuel which will be used then. Some autos and trucks on the road at that time may have shifted from gasoline to turbine or free-piston fuels.

Home fires burning . . . The demand for light heating fuels also is closely tied to population trends.

Their increased use depends on new-home construction which, in turn, is related to family formation. Many factors determine the actual number of new homes built each year, but in the long run any big increase in the number of families in the country will boost construction of new homes.

The period of big gains in family formations and new-home building will lag 4 years behind gains in motor-fuel use caused by teenagers being eligible to drive in 1963. Thus big spurts in home building and heating-oil consumption should start about 1967.

Speed a factor . . . All indicators point to greater demands for energy—especially petroleum—from the transportation segment of our economy.

Changes in methods of transportation have been important factors in the past in the rapid growth in over-all use of energy and particularly in gains by petroleum.

Since the end of World War II, special emphasis has been put on speed and power in transportation. Little recognition has been given to costs in terms of extra energy required.

Announced shifts to jet power for commercial airlines indicate that speed still will be a prime factor for years to come. Also in the automobile field any changes in engine design to increase efficiency probably will be absorbed by added horsepower.

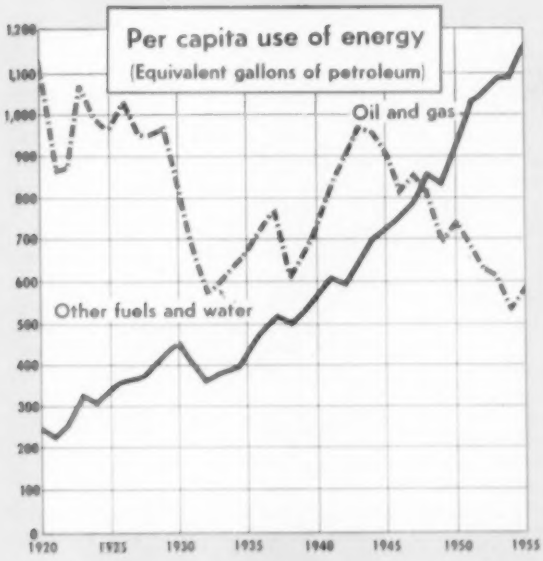
Another factor in rising motor-fuel demand is the growth in number of two-car and even three-car families. This trend is expected to continue until the availability of road space becomes a limiting factor.

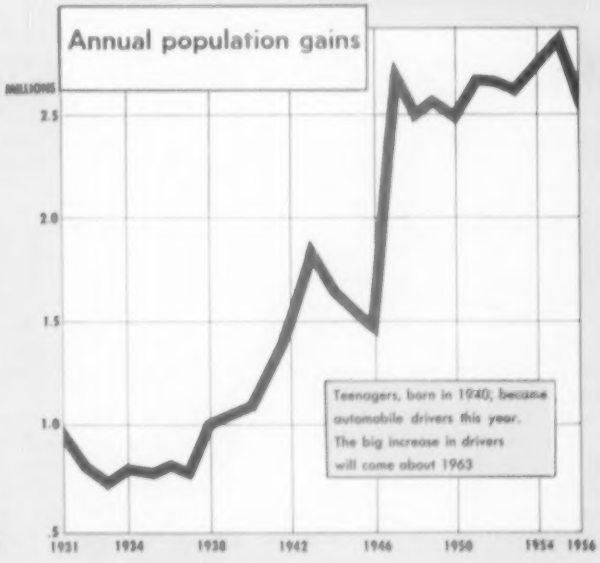
The demand for faster movement of freight may cause some changes in rail transportation. In general, a cut in transportation time means an increase in energy requirements.

Rapid increases in energy requirements tend to bid up the prices for fuels. In many cases costs of the added supplies of certain fuels may prevent them from expanding at the same rate as the over-all energy demand.

What about scarcities? . . . Actual scarcity of fossil fuels is believed many years down the road. It may become a factor toward the end of this century.

High energy costs and actual scarcity of fuels ultimately will promote the





development of methods to use atomic and solar energy.

As long as atomic energy depends on fission of materials in limited supply, this source does not differ much from fossil fuels. Some experts believe that development will be fast enough to make atomic energy at least a small factor in the energy picture some time in the last quarter of this century.

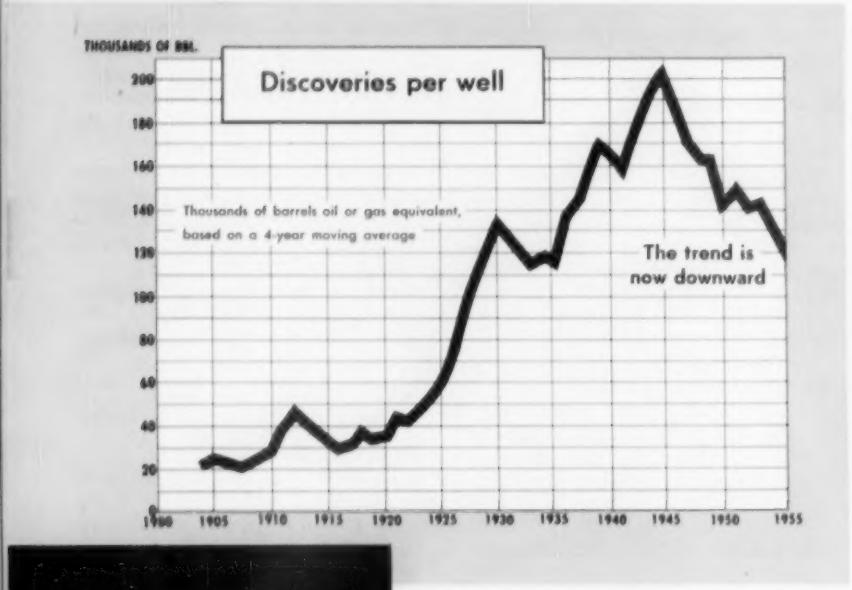
By that time some progress may have been made in developing a way of storing solar energy at a cost competitive with other forms of energy. This harnessing of solar energy may become the problem of chemists or botanists. The question is to find a way to use the sun's energy in certain endothermic reactions to produce fuels from cheap sources.

This does not imply that we are running out of oil. But if our demand for energy continues to increase at rates equivalent to that of the last 50 years, drillers probably would not be able to cut enough hole to find the oil and gas needed. This assumes that petroleum holds a corresponding percentage of total energy it does today.

Fuel efficiency . . . Oil and gas demand in the future may be affected by sudden rise in energy costs, most efficient use of fuels, and automation.

Rapid growth in use of oil and gas for home heating has been an important factor in growth of petroleum in the last 10 years. Any great rise in fuel costs would tend to produce changes in the home-heating program.

Even the most modern methods of heating or cooling homes waste much energy because of the need for make-up air from the outside. In the future, a well-insulated home may be able to reduce the amount of energy needed for heating to a small fraction of current requirement.



Drilling

Ahead: 72,000 Wells in '61

THE nation is not running out of oil. But well drilling cannot continue to increase at the rate of growth experienced in the last 5 years.

Total completions this year will climb to about 58,600 wells. The total for 1951 was 44,516. The rate of gain was 5.6 per cent a year for the 5-year period.

If drilling were to continue increasing at the same rate, total completions for 1973 would amount to about 150,000 wells. Total well completions from 1956 through 1973 would exceed all the 1,650,000 wells drilled since the Drake discovery.

Not even the most optimistic published estimates on drilling have mentioned 150,000 wells per year for any year. The present outlook for drilling is for continuing increases but with smaller percentage gains per year.

Drillers may expect to drill 61,500 wells in 1957 and cut 251,700,000 ft. of hole. The annual drilling program will increase to 72,000 wells by 1961 with 308,200,000 ft. of hole.

Demand is the key . . . The projection of drilling for the next 5 years is based on need for oil and gas both for consumption and for addition to reserves.

So the starting point for a forecast of drilling for a particular year is total demand for products and gas in that year. The supply to meet this demand will be divided between U. S. production and imports. Over a period of years, supply will be slightly larger than demand to cover small increases in stocks.

But wells must be drilled to find more oil and gas than the amount actually produced in a year. They must find enough oil to maintain a near-constant ratio between reserves and production. The number of wells needed thus will depend on the average volume of oil and gas found per well and the slight changes in the ratio of reserves to production.

Take the outlook for 1957 for example. Domestic demand is estimated at 9,396,000 bbl. of crude daily. Export needs are put at 315,000 bbl. daily. Total demand thus is 9,711,000 bbl. daily. Natural-gas consumption and loss is estimated at the equivalent of 5,120,000 bbl. daily.

To meet this total liquid demand of 9,711,000 bbl. daily, domestic production is expected to supply 8,148,000 bbl. daily and imports 1,592,000 bbl. daily. This will result in an addition to stocks of 29,000 bbl. daily.

Drillers in 1957 will have to drill 61,500 wells to supply the domestic oil and gas production required and add sufficiently to reserves. These wells should find a total of 7,393,000,000 bbol. of oil and equivalent gas. Of this 4,843,000,000 bbl. will be produced during the year and 2,550,000,000 bbl. will be added to reserves. This will keep a 16.1 ratio of total reserves to production.

The 4,843,000,000 bbl. of oil and gas, when broken down on a daily basis will furnish the 8,148,000 bbl. daily of domestic crude and gas equivalent to 5,120,000 bbl. daily.

Things to watch . . . Several interesting trends can be expected in the oil business within the next 5 years.

Among them:

. . . Demand is riding an upward curve. Domestic demand is expected

to top 10,000,000 bbl. daily for the first time in 1959. It will climb to about 10,860,000 bbl. daily by 1961. The total demand for that year will be about 11,150,000 bbl. daily.

. . . Imports are rising too. Total imports will continue upward in the 5-year period. But the rate of increase is expected to remain close to that of crude production.

If the gain in imports picks up at a faster rate, it can have only two results: Lower domestic production and a reduction in number of wells drilled. The tremendous increase in imports is shown graphically in the table on supply and demand trends. In 1947 imports were only 436,000 bbl. daily. By 1956 they had reached 1,473,000 bbl. daily and are expected to touch 1,740,000 bbl. daily in 1961.

. . . Ratio of reserves to production is sliding. The over-all ratio is expected to decline slightly the next 5 years. Most of the reduction will be in natural gas with a smaller effect from natural-gas liquids.

The total ratio of oil and gas reserves to oil and gas production has been dropping gradually since 1949. The ratio was 19.2 that year because production for the year was low. By the end of 1955 the ratio was down to 16.4. It is expected to slide to 16.1 in 1957 and 15.6 in 1961.

In the postwar period, ratio of crude reserves to crude production has remained near 12 or 13. If this ratio goes much above 13, the crude market tends to soften. The market becomes tight when the crude oil is scarce enough for the ratio to drop much below 12.

Gas reserves, meanwhile, have been building up over a period of years. In many cases, gas was found by operators hunting for oil. This accumulation of reserves continued until the ratio of gas reserves to gas production for 1946 was 32.5. But by 1955 this gas ratio dropped to 22.1.

. . . Average volume of oil and gas found per well also is dropping. The short-range picture of this trend is shown in the accompanying table on production and drilling. The longer-range study is detailed in the chart on "Average Discoveries Per Well."

The table pinpoints the present situation. High point of discoveries since 1947 came in 1951 when explorers averaged finding 176,540 bbl. of oil and equivalent gas per well. The average had slipped to 124,910 bbl. in 1955.

The outlook for the next 5 years also is downward. Volume of new oil and gas found is expected to be 120,200 bbl. per well in 1957, 118,000 bbl. in 1958, and a dip to 114,000 bbl. in 1961.

The picture of historic trends in oil discoveries on the chart shows that starting early in this century the volume of oil and gas found per well climbed steadily. This was true until about 1945. Since then there has been a general downward trend.

For this chart, total oil and gas found in any year is the sum of production during the year and net additions to oil and gas reserves. Since there were no published estimates of gas reserves for some of the years, it was assumed that increases in gas reserves followed a straight-line trend for these years.

Any minor variations from actual for any particular year would be offset by the total for the following year. Also, any minor variations are smoothed out by plotting the information as a 4-year moving average. Points are plotted on the end year of the 4-year period.

Peak of volume per well was reached in the 4-year period ending in 1945. The general trend has been downward since then. Highest average for a 4-year period was a little better than 200,000 per well drilled.

There is cold comfort in one aspect of these statistics. The average per well discovery currently is still above the average for all wells drilled since the Drake discovery. Through 1955 the average for all wells drilled by the industry was a little less than 100,000 bbl.

Payoff vital . . . Another study shows there is a definite relationship between wells drilled in any year and the value in constant dollars of the oil and gas produced that year.

The equation for this relationship is:

$$Y = 0.15372 \times - 0.396643$$

where X equals wells drilled in thousands and Y is value of oil and gas in billions of 1955 dollars.

On this basis, it would take oil and gas sales amounting to the equivalent of 11.1 billion 1955 dollars to sustain drilling of 72,000 wells in 1961.

Needed: More Drilling To Find Oil for Rising Production

	Production					Drilling			
	Oil and Gas Produced*	Net Additions to Reserves*	Total Found*	Ratio, Reserves to Production		Oil and Gas Found Total*	Oil and Gas Found Per Well†	Total Wells Drilled	Total Footage‡
1947	2,930	1,597	4,527	17.9	1947	4,527	136,680	33,122	114,061
1948	3,162	3,404	6,566	17.6	1948	6,566	165,070	39,778	137,392
1949	3,045	2,642	5,687	19.2	1949	5,687	145,680	39,038	138,003
1950	3,337	2,027	5,364	18.1	1950	5,364	123,940	43,279	159,288
1951	3,827	4,028	7,855	16.9	1951	7,855	176,450	44,516	172,331
1952	3,990	1,749	5,739	16.6	1952	5,739	125,250	45,821	187,190
1953	4,131	3,380	7,511	16.9	1953	7,511	152,420	49,279	198,839
1954	4,145	466	4,611	16.9	1954	4,611	85,500	53,930	218,986
1955	4,437	2,644	7,081	16.4	1955	7,081	124,910	56,682	226,270
	Forecast					Projected Need for Drilling			
1956	4,658	2,550	7,208	16.2	1956	7,208	123,000	58,600	236,100
1957	4,843	2,550	7,393	16.1	1957	7,393	120,200	61,500	251,700
1958	5,048	2,550	7,598	15.9	1958	7,598	118,000	64,400	266,000
1959	5,252	2,550	7,802	15.8	1959	7,802	115,900	67,300	281,400
1960	5,468	2,550	8,018	15.6	1960	8,018	115,000	69,700	294,900
1961	5,657	2,550	8,207	15.6	1961	8,207	114,000	72,000	308,200

*Includes natural gas expressed as crude, using 6,000 cu. ft. of gas equals 1 bbl. of crude. Millions of barrels.

*Millions of barrels per year. †Barrels per well, including gas at its crude equivalent. ‡Thousands of feet.

More Refinery Building Ahead

Refining

BIG problem for refiners in the next 5 years will continue to be expanding processing.

This trend has been established in the last 3 years. Capacity of the various product-upgrading processes in refineries has increased at least three times as fast as the basic crude distillation capacity.

For the years 1954 and 1955, gains in just two processes—cat cracking and cat reforming — amounted to more than three times increases in distillation capacity. These processing plans will be governed by two expected developments in fuels. They are:

. . . **Jet fuels** will account for a fair percentage of the over-all increase in demand for motor fuels over the next 5 years.

. . . **Higher octane gasoline** will be in great demand. As antiknock requirements move above 100-octane for new cars on the road, the refiner will be faced with a problem.

This problem is not adding processing capacity to make this fuel in quantity after 1960. It is to build capacity in time to produce some in 1957, more in 1958, and still more in 1959.

Two trends revealed by statistics show the refiner is an efficient operator and is getting more so.

For example:

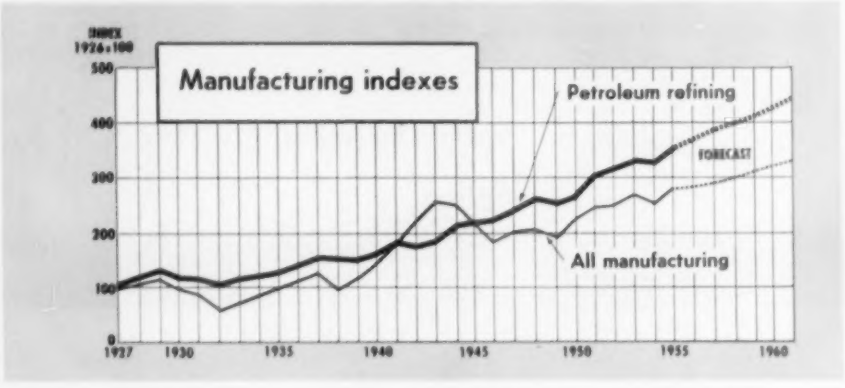
. . . **Hydrogenation** is growing due to availability of by-product hydrogen from cat reforming.

Before 1975, the refining industry may have enough low-cost hydrogen to convert most residuals to high-value products.

. . . **Crude runs to still** are edging near capacity. Despite the unusual expansion programs of refiners, the crude runs have been closer to total capacity over the past 5 years than at any time since 1930.

For the 6-year period from 1950 through 1955, runs averaged about 87.6 per cent of total average capacity on a calendar-day basis. This total capacity included shut-down capacity.

Total capacity, calendar-day basis, is expected to reach 10,000,000 bbl. daily by the end of 1959 and almost 11,000,000 bbl. daily by the end of 1961. This represents an addition of almost 2,400,000 bbl. daily for the 6-year period 1955-61.



Four Major Gas Lines A Year

Pipeline

GAS discoveries and potential gas markets could support four new major gas pipelines a year in the next 5 years.

This coupled with the growth of product lines adds up to an optimistic outlook for pipeline construction.

Natural gas has been the big factor in pipeline construction since the end of World War II. There is every indication that gas lines will account for the major portion of pipeline construction over the next 5 years.

This importance of gas to pipeline expansion is illustrated by The Oil and Gas Journal's forecast for 1956. It called for about 12,000 miles of gas lines to be built and 6,000 miles for liquids.

Two factors may limit gas-pipeline construction over the next 5 years besides pipe availability.

There must be:

. . . **A market for gas** at competitive prices.

. . . **Gas reserves** sufficient to support a pipeline program to move the fuel to customers in high-demand areas.

Enough homeowners and manufacturers in northern and eastern states are still seeking gas to prove that the potential market has not been satisfied.

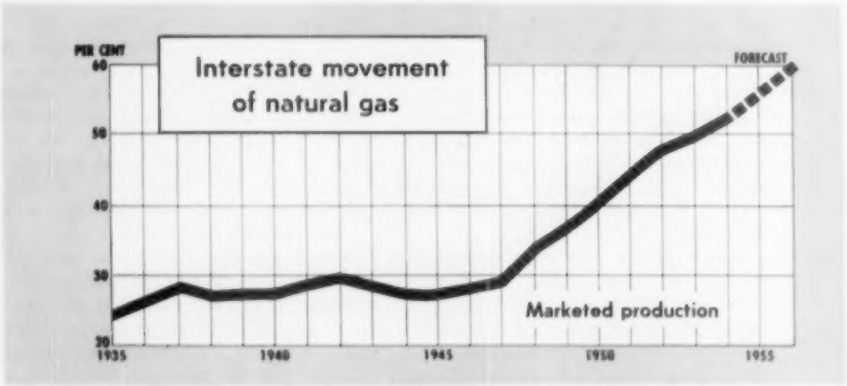
The volume of gas found each year indicates that the reserves will be available to support the four major pipelines a year. Here's how it figures.

Total gas found each year (discoveries, extensions, and revisions) for the past 10 years has averaged about 15 trillion cubic feet per year.

Average capacity of a 30-in. line is about 400,000,000 cu. ft. per day or about 146 billion cubic feet per year. This rate would call for a dedication of about 2.9 trillion cubic feet to cover the 20-year period.

Thus discoveries of 15 trillion cubic feet per year would be enough for about 5.2 new lines per year. Since gross discoveries include about 8 per cent for gas wasted or lost, available gas would be enough to support 4.8 new lines per year.

Also, only about 80 per cent of the increase in marketed production of natural gas since 1947 has gone into interstate shipments. If this ratio continues, gas available for interstate shipment would support four new lines a year.



Those Pembina Permanent Completions

They're used for multiple fracturing, pumped wells, and as an aid to workover when low-pressure squeeze cementing is employed. These squeezes have been almost 100 per cent successful.

by Sidney Keen

PERMANENT-completion techniques are now widely used in Canadian oil fields. Their use has been accelerated by completion problems in development of Pembina oil field. Low-pressure cement-squeeze workovers, using permanent-completion methods, are also quite common. The most recent innovation has been the introduction by a service company of a permanent-completion vehicle which combines in one unit, cementing, piano wire line, and perforating equipment.

• Save rig costs.

The economic advantages gained by adoption of permanent completion practices, that is, the gaining of 1 to 2 rig-days, cheaper completions, and reduction in cost of workovers by one-third to two-thirds, have proved to be real in practice. Equal if not more important intangibles have been the freeing of the drilling rig from the well-completion phase of operations. This has led to greater efficiency and flexibility in both well completions and servicing.

• Improved completions.

Greater economy in well completions and servicing is brought about in a number of ways by use of permanent-completion systems. No costly drilling rig is kept waiting on results of core and reservoir analyses and log correlation and interpretation. This means that more efficient study is given to the science of well completion. The margin of safety is increased greatly in permanent-completion operations because all procedures take place with the wellhead securely in position. Furthermore, the removal of the need for running complicated and intricate equipment on tubing strings with service rigs reduces markedly the chances of expensive fishing jobs. In those instances where permanent completions have run into trouble, for example, cementing in of aluminum tubing, the difficulty is minor and easily rectified by drilling out.

• Better timing.

The advantage of a separate completion phase is appreciated in Canada where climatic and physical conditions interfere with and delay completion procedures. The spring breakup has always hindered continuous drilling operations. At this time of year the spring thaw and rains usually render lease roads impassable. With permanent completions, however, careful organizing will permit rig moves just prior to breakup. Lost drilling time is reduced to a minimum while completions may be postponed until conditions are more favorable. In winter, when subzero temperatures prevail, no special heating facilities are required because operations may be performed with oil in complete safety and without risk of freezing up.

What Is a Permanent Completion?

The term "permanent completion," or "permanent type of well completion" refers to wells in which the tubing and wellhead are installed only once in the life of a well. The wellhead, tubing string, and other special subsurface equipment are installed while the drilling rig is still on location. The method allows the rig to move off prior to perforating, acidizing, fracturing, or performing any other process connected with placing a well on production.

The need for a rig is abolished as all operations are carried out by means of special wire-line methods and tools in conjunction with special subsurface equipment. Workovers that may be performed during the subsequent life of the well are executed, in a similar manner, without the need for service rigs.

• More flexible.

The employment of permanent completion methods in exploration activities is only just beginning. In the northern areas, rigs are isolated in muskeg in the summer and can be reached only by light aircraft which land on airstrips cut beside the wells. The very light and portable nature of permanent-completion tools makes the system ideal for such means of transportation and enables important completion and testing operations to be carried out in the summer instead of waiting until the winter freezeup.

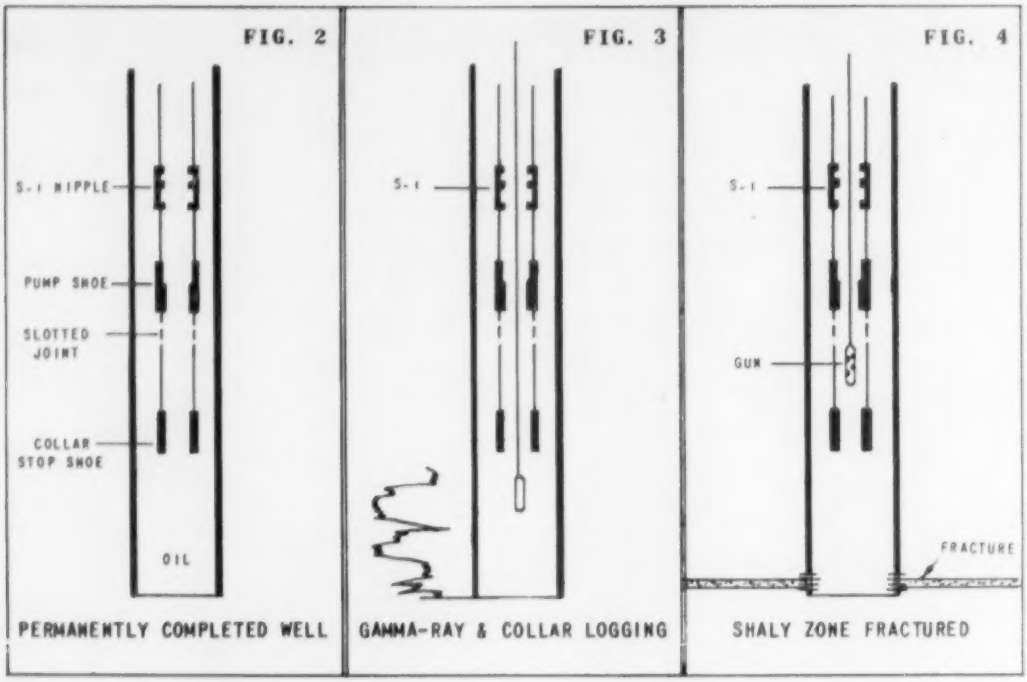
Two phases of permanent-completion operations taking place at the present time, namely, completions in Pembina and low-pressure modified cement squeezing at Joarcam and Leduc oil fields, exhibit interesting aspects of permanent-completion techniques. These will be discussed in the following sections.

Permanent Completions in Pembina

The Cardium sand of Pembina oil field has presented a difficult problem to the completion engineer. The sand has a relatively low permeability in the best section which decreases to less than 1 md. in the shaly sand. Until fractured, a large majority of wells will not produce oil in commercial quantities though drilled in with oil-base muds and perforated and stimulated with mud cleanout acids. After fracturing, a well may flow at rates over 200 bbl. per day.

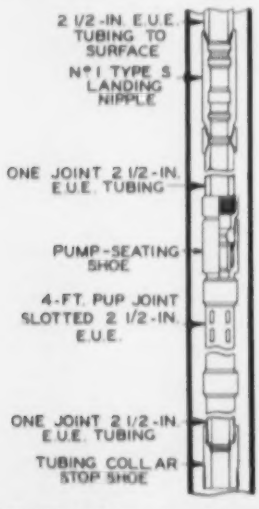
The Cardium sand occurs at an average depth of 5,000 ft. It consists of three main zones, an upper conglomerate which is erratic in occurrence underlain by a main fine-grained sand having a gross thickness rarely exceeding 25 ft. Beneath the main sand lies a shaly sand zone with a maximum over-all thickness of 35 ft.

The following describes how each zone is fractured and brought into pro-



duction by permanent-completion methods. In such a large field it will be appreciated that there will be many variations to this system. It is believed, however, that the system described does indicate, in general, how the Pembina completion problem is being solved today.

Completion . . . First, the drilling crew runs and cements casing through the three Cardium zones. The casing is landed in the slips immediately after cementing. The 2½-in. E.U.E. tubing string, equipped with special permanent-completion nipples, as shown in Fig. 1, is run to the float collar and drilling mud is displaced with oil.


2 1/2-IN. E.U.E. TUBING TO SURFACE
N° 1 TYPE S LANDING NIPPLE
ONE JOINT 2 1/2-IN. E.U.E. TUBING
PUMP-SEATING SHOE
4-FT. PUP JOINT SLOTTED 2 1/2-IN. E.U.E.
ONE JOINT 2 1/2-IN. E.U.E. TUBING
TUBING COLLAR STOP SHOE

FUTURE PUMPING of wells completed flowing is provided by this permanent tubing installation. Fig. 1.

The tubing is raised so that the bottom is approximately 70 to 100 ft. above the highest anticipated perforations and is then landed in the tubing spool. The wellhead is next assembled and the drilling rig released. The well is now permanently completed, Fig. 2, and all ensuing operations are performed without a drilling or service rig.

A gamma-ray log is run over the Cardium sands from the bottom of the tubing to the float collar. A casing-collar log is recorded simultaneously. These logs are achieved by means of tubing gamma-ray logging and collar-locating devices, Fig. 3. Correlations of these logs are made with the corresponding portions of the electric logs so that precision perforating of the sand zones may be performed.

Successive fracturing . . . The lowermost sand, the shaly zone, is then perforated by means of an expendable tubing gun. The sand is fractured hydraulically with oil and a feed rate established. If breakdown pressures threaten to exceed safe casing burst stresses, or if the feed rate is unduly low, the zone is generally acidized with mud-cleanout acids. To reach and wash by the zone, the 2½-in. tubing is extended by 1-in. aluminum tubing run and retrieved on 0.082-in. wire line.

Another expendable type of tubing gun is next run down and kept inside the bottom of the tubing in readiness for perforating the middle sand zone.

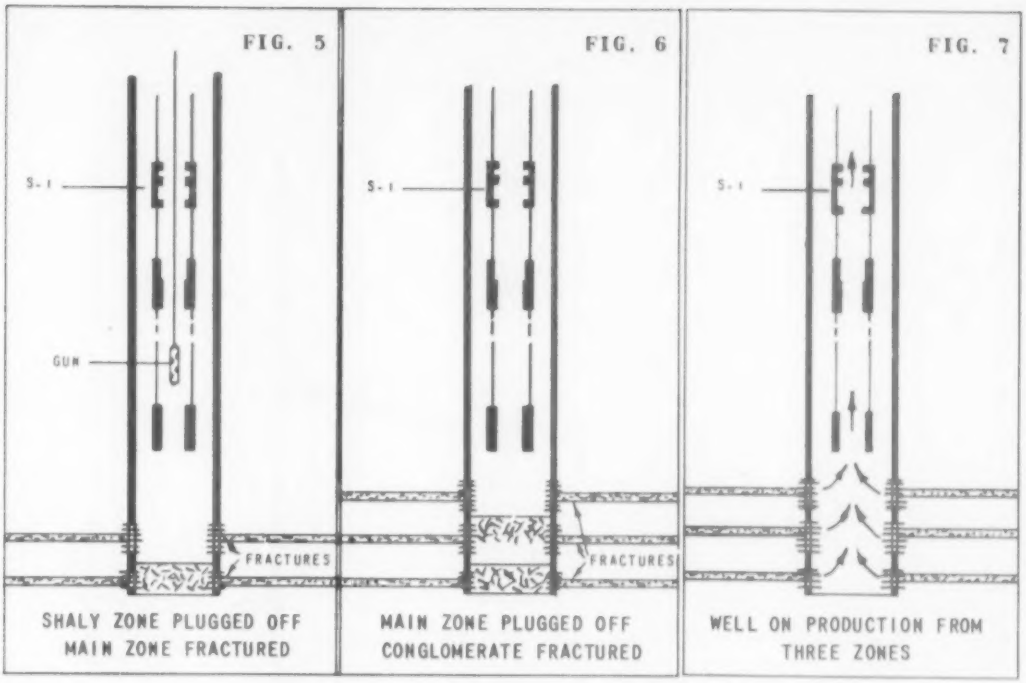
The lower zone is hydraulically fractured with sand and oil down the casing annulus, Fig. 4. (Treatments consist of 15,000 to 30,000 lb. of sand in some 7,000 to 15,000 gal. of patent gelled lease oil, but quantities are subject to much variation). The well is now very much "alive" and if left will produce strongly.

However, the zone is immediately plugged off with either an oil-soluble or self-disintegrating type of plug, depending on the service company employed. These "soft" plugs seal off fractured perforations for periods up to 48 hours. The plugs are generally pumped down the tubing with the gun resting in the casing some distance above the middle sand zone.

Once the lower zone is plugged off, the gun is positioned opposite the mid-

THE AUTHOR

Sidney Keen, petroleum engineer with Imperial Oil, Ltd., was born in London, England. He graduated from the Royal School of Mines, London University, in 1942, with a degree in petroleum technology. He then joined the Royal Air Force and saw service in Europe and the Middle East until demobilized in 1947. The following 6 years were spent in the oil fields of Trinidad. In 1953 he moved to Canada and joined Imperial.



dle sand zone and the casing perforated. The perforating line and collar locator are then withdrawn and another gun run down close to the bottom of the tubing ready for perforating the upper conglomerate zone. The latter operation is generally carried out with 500 to 1,500-psig. pressure on the wellhead in order to keep the plug in position. Consequently, perforating companies must employ special high-pressure equipment to lubricate guns in and out of wells under pressure.

The middle zone is then broken down, acidized if necessary, and hydraulically fractured with sand and oil in a similar manner to the bottom zone, Fig. 5. The middle zone is, in turn, plugged off and the upper conglomerate subjected to the same cycle of operations, Fig. 6.

In this manner, all three sand zones are perforated, acidized, and fractured in successive operations. After this treatment, the well is able to flow without swabbing. Eventually, the plugs clear themselves and all three zones produce simultaneously into the well bore, Fig. 7.

After varying methods of time, wells cease to flow and can be placed on pump. Due to the special tubing assembly pertinent to this system of operations, the tubing need not be pulled. Sucker rods and subsurface pump may be run directly as explained below.

Permanently-Completed Tubing String

In accordance with the principles underlying permanent completions, the tubing string is equipped with special nipples to handle any future operation on the well without the necessity of employing a service rig. In this instance, however, a rod rig is still necessary to run pumping equipment but this need be only the lightest rig available.

As shown in Fig. 1, the tubing string is fitted with an S 1 nipple, a pump-seating shoe, a perforated pump joint, and a collar stop shoe.

S 1 nipple . . . This is used as a landing nipple for the extension pipe hanger which carries the 1-in. fixed or 1½-in. telescoping aluminum tubing extension joints. The S 1 nipple, in Pembina field, would be employed mainly for acidizing to help in breaking down the formation and insuring better fracturing conditions, or for sand-cleanout jobs.

For acidizing, the fixed 1-in. aluminum joints are used, Fig. 9, while for sand-cleanout jobs, a combination of 1-in. fixed and 1½-in. telescoping joints is employed, Fig. 10. Sand fill-up of casing may occur either during fracturing, in the event of a "sandoff," or through a slow steady return of sand into the well bore during the productive life of the well. As many as eight telescoping joints have been run in one well for sand-cleanout purposes.

However, to date, no system is available for running and retrieving these 1-in. telescoping aluminum joints under pressure. This represents a definite weakness in the system though it has not, as yet, seriously hampered completion operations. The S 1 nipple may also be used for landing special chokes and regulators, safety valves, and various plugs during the flowing life of the well. As no water or gas problem exists, no low-pressure squeeze-cementing or plug-cutting jobs are anticipated.

Seating shoe . . . A feature of this permanent completion application is the knowledge that sooner or later most of the wells in Pembina field will be placed on pump. All installations are designed, therefore, so that sucker rods and subsurface pumps may be run without the need for pulling tubing.

All equipment below the S 1 nipple in Fig. 1 pertains to the permanently completed pumping phase of operations. Separated from the S 1 nipple by a complete joint length of tubing is a full-hole mechanical-lock type of pump-seating shoe. The pump-seating shoe is separated from the S 1 nipple by a full joint to facilitate location of the S 1 nipple by 0.082-in. wire-line tools. The inside diameter of the pump seating ring is 2.261-in. as against 2.313 in. for the S 1 nipple. The pump seating ring is, therefore, undersized in order that the pump lock will pass through the S 1 nipple and seat in the shoe.

Gas anchor . . . The slotted joint serves as a gas anchor when the subsurface pump is seated in the top lock position and the bottom of the tubing is closed off as shown in Fig. 8. When first run in the well, the slots are covered

with magnesium to insure displacement of mud by oil over a critical portion of the hole.

It has been found that the slug of mud left in the bottom of the hole, if the slots are left uncovered, may cause unnecessary holdup of the lightweight logging and perforating equipment. More seriously, severe plugging of the lowermost perforations generally takes place when tubing guns are fired in mud. This plugging of the perforations leads to high breakdown pressures, sometimes beyond the safe bursting pressures of casing. The magnesium is dissolved out of the slots upon the first acid treatment.

Collar stop . . . The bottom of the tubing is closed off by means of a collar stop fitted with cups as shown in Fig. 8b. The collar stop is run on 0.082-in. wire line and locked in the collar stop shoe so that the cups form a seal to fluids both in upward and downward directions.

The collar stop is placed in position before the pump is run. It can be removed at any time for further fracturing operations, for sand-cleanout purposes, and for any other operation demanding unobstructed passage through the tubing. The inside diameter of the collar stop shoe is 2.260-in. while the diameter of seating cups is 2.250-in. The cups enlarge when subjected to pressure to form a seal against the wall of the shoe.

Some problems . . . Completions in Pembina oil field call for relatively complicated techniques, which at the present time are by no means perfect. Specific limitations lie in the fields of gamma-ray logging and perforating.

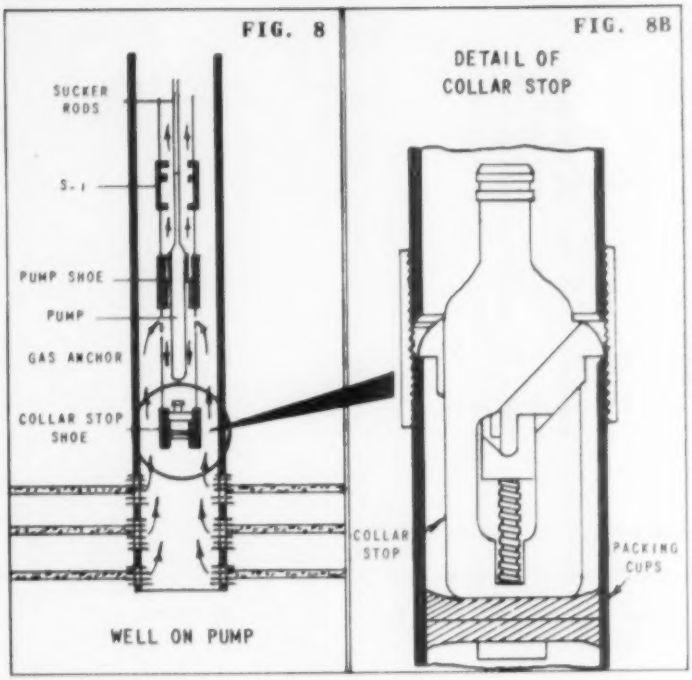
The smaller gamma-ray logging devices lack the accuracy and repeatability of the larger types. However, they are only used for correlative purposes to achieve accurate perforations of the sand lenses. Within these limits they appear to be doing useful work.

Gun debris, severe plugging of perforations, and lack of penetration have been serious limitations on early tubing guns. The "swing-jet" type of gun which possesses better debris and penetration characteristics has, in a large measure, almost superseded the horizontal or angle-mounted jet guns.

The swing-jet gun is complicated and subject to mechanical breakdown, especially under the severe Pembina completion conditions. The gun cannot be fired in acid, either, unless specially coated.

New, improved tubing guns with charges mounted horizontally are beginning to appear on the market. The latter guns may be fired in acid. Removal of gun debris from tubing has, on occasion, been successful with caustic soda solution.

The running and retrieving of tubing guns under high-pressure conditions, that is, from 500 to 1,500 psig., would appear to be facilitated by smaller-diameter perforating wire lines. Unfortunately, the life of smaller-diameter wire lines, at present, is so small as to almost prohibit their general use.



Permanent Completion Workovers at Joarcam

Joarcam oil field was practically drilled up before permanent completions were introduced. However, this field became the proving ground for permanent-completion type of workovers employing the low-pressure squeeze techniques.

The Joarcam reservoir is a stratigraphic trap in the Viking member of the Colorado formation and occurs at an average depth of 3,250 ft. Average sand thickness is 10 ft. Oil occurs in a long, thin belt striking northwest and southeast, while a gas cap borders the northeast edge of the pool. The majority of workovers are undertaken in order to reduce high-gas-oil-ratio conditions due to either gas coning or failure of primary cementation.

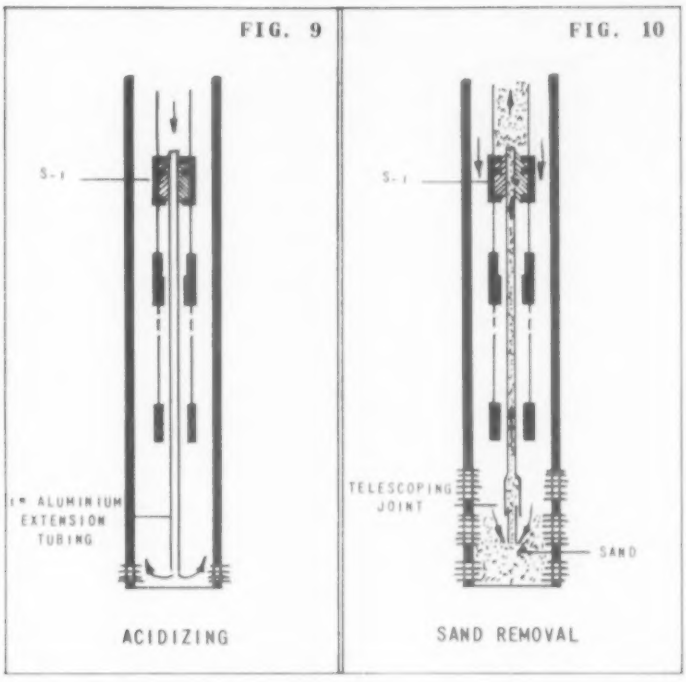
The low reserves per well, the relatively high cost of conventional type of cement squeezes, and the possibility of reservoir damage during such operations, provided the impetus for the application of the low-pressure modified cement squeeze. Savings are approximately two-thirds the conventional-type cement squeeze cost.

Use rod rig . . . All wells in Joarcam field are pumping. Consequently, sucker rods and subsurface pumps must be removed before workover operations using permanent-completion techniques are undertaken. The ultimate in permanent completions is, therefore, not realized since a service rig must be employed at certain stages of the operations to remove and replace subsurface pumping equipment.

However, it has been found that if only the lightest of service rigs is required to pull subsurface equipment, and provided the well has been set up previously for permanent completion type of workovers, substantial reductions in workover costs may be realized. In Joarcam, a rod rig is employed to pull and replace the subsurface pumping equipment and to swab the well. It plays no other part in the operations.

This system is dependent on good communications and immediate availability of service companies for the various operations of running and retrieving tools on piano wire line, squeeze cementing, logging, and perforating. Choice of a particular workover system as far as pumping wells are concerned, is, in a large measure, dependent on local field organization and service conditions.

At Joarcam, the wells are permanently completed by using only a P-nipple. The P-nipple doubles as an A.P.I. pump-seating shoe, (cup type of holddown), and also as a seating nipple for the 1-in. extension pipe hanger. No gas-anchor system is used, the



2½-in. strings being run open ended. When swabbing or other operations take place, to avoid loss of tools or instruments, a collar stop (without cups) is generally run and set in the last collar recess of the tubing.

Low-Pressure Squeeze Cementing

In perforating low-pressure squeeze cementing with modified cements, it must be emphasized that the process is related to definite laboratory findings. The closer field conditions approximate the laboratory, the better the chances of success. At Joarcam, the modified cement used is a mixture of common portland cement, 12 per cent bentonite, and 0.5 per cent calcium lignosulfonate. These are laboratory-recommended proportions for the formation temperature of 110° F. in the Viking sand. Essential characteristics of this cement mixture compared to ordinary neat cement are shown in Table 1.

TABLE 1

	Portland cement	Modified cement
Additives (per cent by weight)		
Bentonite	0	12
Calcium lignosulfonate	0	0.6
A.P.I. 30-minute water loss (at 60° F. and 100 psi.)	800 cc	96 cc
Permeability of filter cake	24.8 md	0.24 md

The modified cement mixture used has greatly reduced water-loss characteristics and an almost impermeable filter cake. In the well bore, when such a cement mixture is compressed against perforations, filtration of the cement against the sand leads to quick buildup of an impermeable filter cake or nodule. As this nodule is impermeable no further filtration can take place.

The amount of cement used and loss of filtrate is so small that the composition of cement inside the casing is virtually unaltered. Only small volumes of cement are mixed, about 10 bbl., and squeeze pressures are kept as low as possible since formation of a filter cake of cement is not dependent on high pressures.

Feed rate . . . An important preliminary to low-pressure squeeze cementing is the flushing of all traces of mud and oil from the perforations and formations with salt water. In the field it was found that salt-water feed rates could not be achieved without possible fracturing of the formation or reaching pressures near, or greater than, the bursting strength of the casing.

It was presumed that the wells were plugged due to being drilled or perforated in mud. Acidization of the perforations with 50 to 250 gal. of 7 to 15 per cent hydrochloric acid has usually cleaned up the formation sufficiently to permit a feed rate with salt water within a pressure range suitable for low-pressure squeeze cementing.

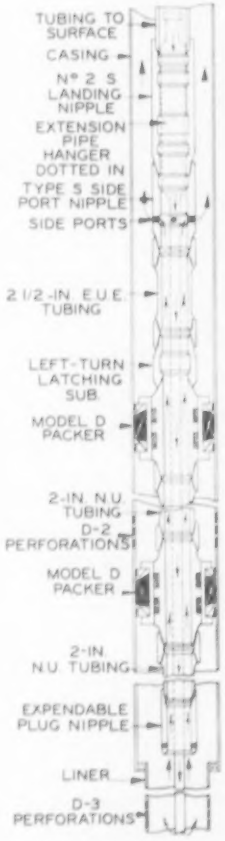
Some 10 to 15 bbl. of salt water are pumped away into the formation preparatory to squeezing. A clean sand condition before a low-pressure squeeze is attempted enhances the possibility of obtaining a strong cement bond.

Cement preparation . . . Complete mixing of the dry ingredients has been found essential to the preparation of a good modified cement slurry. Mixing of the dry ingredients has been performed generally with the aid of a rotary mixer. Failure to insure a thorough dry mix results in a lumpy slurry with poor sealing qualities.

Fresh water is next added to the dry mix until the slurry weight is between 12.5 to 13.5 lb. per gallon. Volume of slurry is generally about 10 bbl. Mixing of slurry is performed at the surface in paddle tanks and jetted through pumps to insure a uniform consistency.

Both the volume and weight of slurry are carefully controlled before injection into the well. As the cement mixture is retarded, due to the calcium lignosulfonate, no early setup of cement need be anticipated. Thickening times are of the order of 2 hours and more.

The squeeze . . . After the 1-in. aluminum extension pipe has been run and set in position, in a similar manner to Fig. 9, and a soft-water feed



LOW-PRESSURE SQUEEZE of a dually completed well was performed with this equipment. Lower perforations were successfully plugged. Reperforation lowered gas-oil ratio. Fig. 11.

rate established, the modified cement is spotted across, and some 25 to 50 ft. above the perforations. Thus, cement is opposite each perforation prior to squeezing. A gentle bradenhead squeeze is applied and a small volume of cement squeezed away. The pump is then shut down for about 15 minutes.

Theoretically, a cement nodule should have been built up across each perforation. However, due to the fact that some perforations are more permeable than others, only a certain percentage of nodules are formed. The cement is, therefore, staged at intervals of 10 to 15 minutes, until a steady locked-in pressure of from 1,500 to 2,000 psig. is obtained. It is imperative that only a fraction of a barrel be squeezed at each stage, as the volume of cement available is extremely limited.

Staging, under these conditions, has taken place over periods of 2 hours and longer without premature setting up of cement. At the conclusion of the squeeze, the excess cement is removed by reverse circulation.

Calcium chloride . . . The squeeze operation is concluded by spotting one sack of calcium chloride dissolved in about 5 bbl. of water across the perforations and leaving approximately 500 psig. pressure on the wellhead. The calcium chloride accelerates the setting up of the nodules of cement. The 1-in. aluminum tubing is removed from the well.

Testing . . . Although the time may be shortened, it has been field practice to swab wells down after 36 to 48 hours have elapsed from time of spotting calcium chloride solution. "Dry" tests have been the ultimate measure of a satisfactory squeeze operation. After the test, the well is generally filled with salt water and reperforated by means of tubing guns. The well is then swabbed into production and placed on the pump.

By adhering closely to the above practices, low-pressure cement squeezes have established an almost 100 per cent efficiency in shutting off existing sand perforations in one operation.

Success ratios in achieving a lowering of gas-oil ratios in the wells squeezed have been low to begin with. However, early applications have been marred by imperfections in application of the technique. Later squeezes indicate success ratios of the order of 50 per cent with a trend towards higher ratios still as the technique is carefully applied on a basis of adequate reservoir knowledge and study.

Limestone applications . . . Low-pressure squeezes are applicable to sandstones and possibly some intergranular limestones where filtration and deposition of an impermeable cement filter cake in the pores of the formation can take place. Consequently, the application of this technique to the vuggy limestone reefs of Leduc and Redwater was not at first contemplated. However, the success of two recent applications, both in the Leduc D-3 reef, has engendered interest and may indicate a larger scope than was at first anticipated.

The first application was in a dual D-3 and D-2 well. The standard dual tubing string was pulled and the special tubing string, as shown in Fig. 11, was run. A 1-in. extension tubing was next set to the bottom of the well and the hole displaced with salt water.

A low-pressure cement squeeze was then successfully performed on the high-gas-oil-ratio D-3 zone. Reperforation of the D-3 zone was achieved by means of a tubing gun. The special workover string was then replaced with the original standard dual tubing string. A reduction in gas-oil ratio of the D-3 zone to normal was obtained.

The second application was a simple low-pressure cement squeeze of a D-3 zone well in a similar manner to the Joarcam operations. This application was also successful in reducing the D-3 gas-oil ratio to normal. Both workovers indicated that a repair of the primary liner cementation had been achieved.

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ON THE JOB . . . . . IN THE PLANTS

New tanker loading device saves time

THIS hydraulically controlled tanker loading device consists of two lengths of aluminum pipe coupled together by swivel joints. It is mounted on a structural steel frame. A boom and cam arrangement is operated by one man on the control platform. The operator can place the flanged end of the arm aboard a tanker in 1 minute while a two-man crew can make up the flange to the deck manifold.

A free-wheeling mechanism allows for a 40-ft. rise and fall of the ship in the water during loading or unloading. The arm is grounded for static and is spark resistant. The unit can be used at temperatures as low as —60° and up to 225° F. without deterioration or lessening of operating ease.

First installation is at a tanker terminal now under construction in Long Beach. The mechanism was developed by Chiksan Co., Los Angeles.

BOOM AND CAM arrangement may be operated by one man on the control platform.

Here's a new

Mass Flowmeter For Gases

by

J. R. Macintyre

and

R. G. Ballard

Authors are with the instrument department, General Electric Co., Lynn, Mass.

A NEW mass flowmeter has been developed for gases. While it is not expected to completely replace the orifice and diaphragm types, it should be widely used. This is particularly true where high accuracy under varying pressure and temperature conditions is desired.

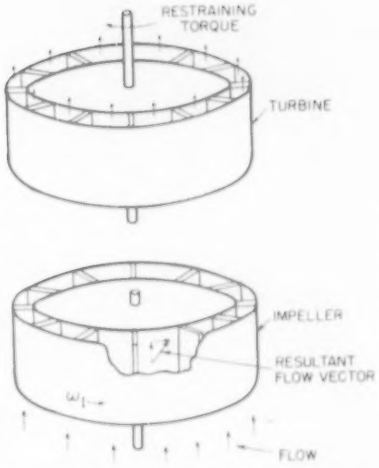
The meter works on the principle that the angular deflection of a spring-restrained turbine is directly proportional to the mass rate of gas flow through the meter.

Energy important . . . The energy available in a given fuel is proportional to the total mass of the fuel and not to the total volume. Even with liquid fuels, this may be very important. For instance, the Strategic Air Command is using mass flowmeters both for in-flight refueling and operating its long-range airplanes.

Within the density limits and specified operating temperatures of accepted fuels, it is theoretically possible to have a 30 per cent difference in the range of an aircraft with the same **volume** of fuel. Uncontrolled pressures and temperatures in gases can cause much greater errors than the same changes in the same parameters in liquids.

This article will describe some work which General Electric Co. has done with its mass flowmeter in the gas-measuring field.

The mass flowmeter was originally developed to measure aircraft fuel flow. Thousands of flowmeters have been supplied and successfully used for this purpose.



BASIC PRINCIPLE of the new mass flowmeter for gases. Fig. 1.

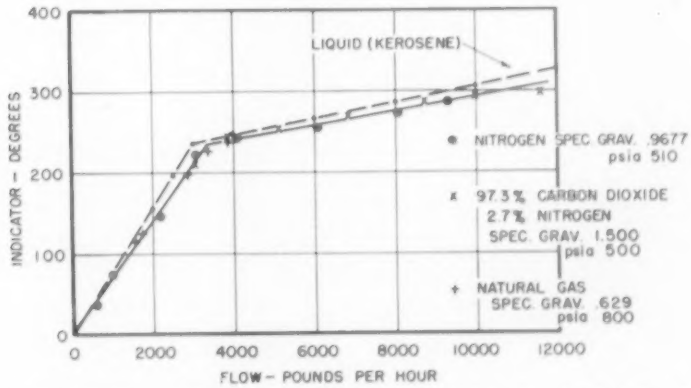
Basic principle . . . Fig. 1 shows the basic principle of the meter. Fluid enters at the bottom and has angular momentum imparted to it by the constant speed impeller driven by a synchronous electric motor. The angular momentum supplied by the impeller to the fluid is then removed by the spring-restrained turbine. It can be readily shown that the angular deflection of the spring-restrained turbine is directly proportional to the mass rate of flow of the fluid.

A standard 0-12,000-lb. per hour aircraft flowmeter was checked with natural gas at 800 psia. This was followed by other checks with nitrogen and with carbon dioxide. The results of these checks are compared with the original calibration for aircraft fuel (kerosine) in Fig. 2. The break in the curve is caused by a dual spring arrangement which is used in the aircraft application to obtain an expanded scale on the fuel flow indicator.

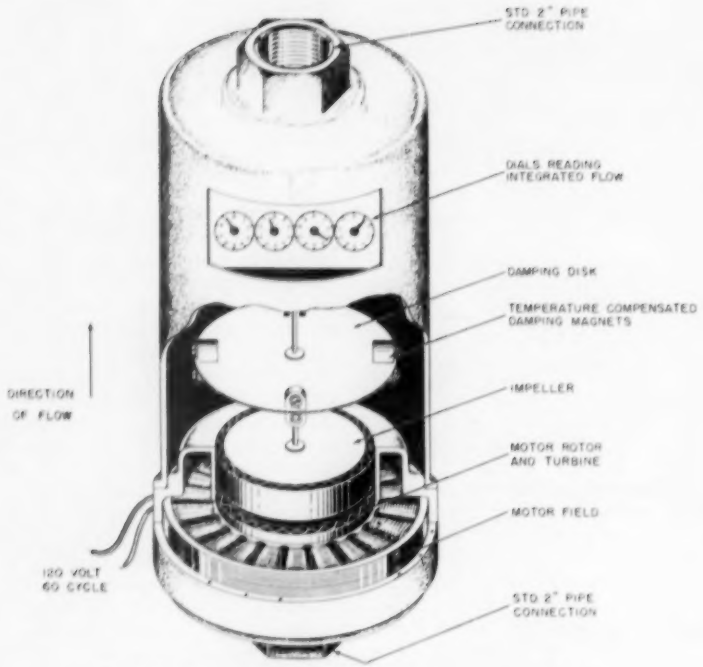
The turbine angular deflections, with gas, were somewhat less than those obtained with liquid. This is attributed to the fact that the impeller and turbine vanes are not exactly parallel to the direction of flow. This effect produces torques approximately proportional to the square of the flow velocity. These torques are appreciable at the higher velocities associated with gas flow rates although insignificant at the same flow rates with liquids.

The gas flow velocities for the tests were between 12 and 19 times the kerosine velocity. This effect, not present in a properly adjusted flowmeter for measuring gas flow, is removed by a simple bending of the vanes in one direction to compensate for the unwanted misalignment in the other direction. Some other errors are associated with the testing equipment and procedures used. In this connection, it is interesting to note that with liquids it has been found that the mass flowmeters are more accurate than the best standards available.

Flow integration . . . The integration of flow, which is necessary for most industrial applications, presents an additional problem which has been approached in two ways. One of the methods involves the substitution of a retarding disk and retarding magnets for the spring restraint, as shown in Fig. 3.



GAS CHECKS on calibration of aircraft flowmeter used for kerosine fuel. Fig. 2.



INTEGRATED FLOWMETER for low-pressure gas. Fig. 3.

The other method uses an electrical servo-operated system with a mechanical integrator driving a counter as the end device. This is shown schematically in Fig. 4.

To date, work with the retarding disk system has been confined to low pressures (about 160 psia.) and low flows (less than 1,000 lb. per hour). The servo-operated system has been used at higher pressure (750 psia.) and higher flows (10,000 lb. per hour).

Fig. 5 is an experimental model of the retarding disk and magnet design. The motor is located in the lower portion and its windings are completely sealed from the gas. The register and retarding disk are clearly visible on the top. The register is read through a window similar to that used on standard diaphragm meters.

Measuring helium flow . . . This meter was slightly modified and used to measure the mass flow of helium gas for an undisclosed process. Table 1 shows the results of a series of tests under pressure, flow-rate, and temperature conditions shown. It may be noted that these accuracies are obtained with more than 30° C. temperature change, and for 25 per cent pressure change, over a three-to-one range of flow rates.

The total weight of helium used was determined by pressure, volume, and temperature measurements of the gas in the supply tank before and after the test run. The calibration was based on an average of the meter revolutions per pound of helium. There are two adjustments in this type of meter which can be optimized if improved testing accuracies show errors caused by temperature or flow-rate changes. Work on improved meters and testing techniques are already under way.

Some further testing has been done at low pressures using a Rockwell orifice type of flow prover as a standard. These tests show accuracies in the order of ±1 per cent over a flow range from 10 to 350 per cent rating. One hundred per cent rating is based on the conventional ½ in. of water pressure drop.

Tests were conducted up to the limit of the prover power supply (350 per cent of rating) and the meter was still operating within 1 per cent accuracy. Below 10 per cent, of nominal rating, errors in the order of 15 per cent are encountered.

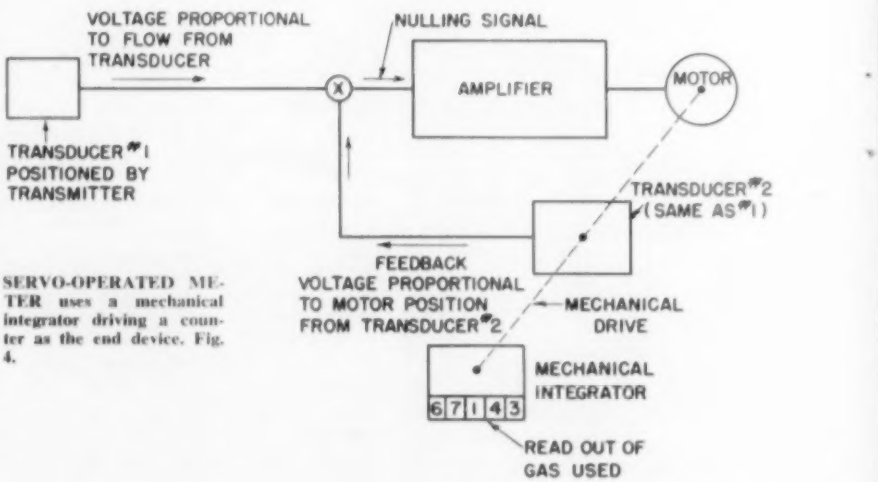
Integrating system . . . Fig. 6 shows the components of an experimental sample of the servo-operated mechanical integrating system. This system has been used to meter the flow of high-pressure (750 psia.) natural gas at rates up to 10,000 lb. per hour. The third component in the picture, on the right, is a turbine-driven generator, which is located in the pipeline to furnish electrical power where necessary.

This flowmeter was installed in a high-pressure natural-gas line near Houston. Some difficulties were encountered, but these did not involve anything fundamental to the method of

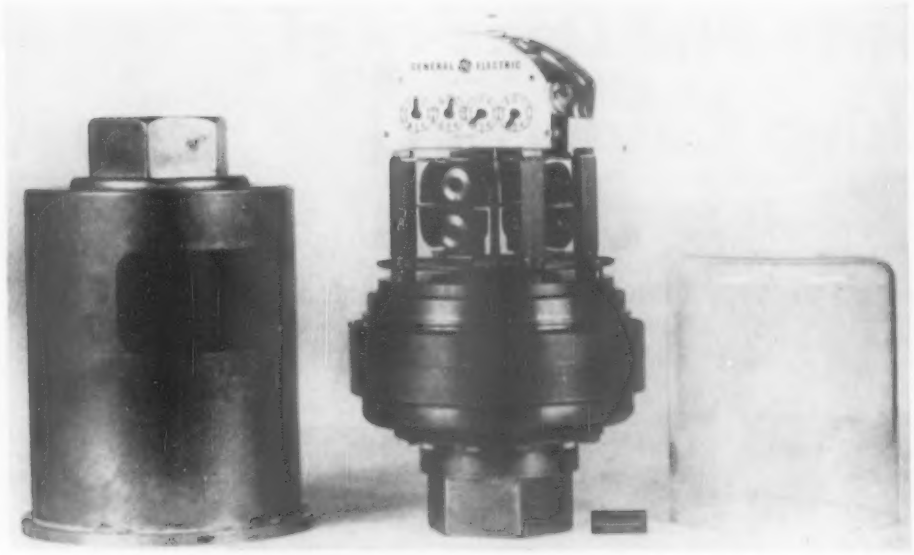
TABLE 1—RESULTS OF FLOW TESTS

Test No.	Lb. used	Pressure, psia.	Average temp., C.	Average flow rate, lb. per min.	Lb. read by meter	Error,* per cent
1	46.4	165	41	4.3	45.8	−1.3
2	38.5	175	38	11.4	38.5	0
3	47.3	165	10	4.5	46.9	−0.8
4	37.7	175	11	12.1	38.4	+1.9
5	38.1	130	15	4.3	38.5	+1.0
6	33.9	175	15	12.3	33.7	−0.6

*Test accuracy ±1 per cent.



SERVO-OPERATED METER uses a mechanical integrator driving a counter as the end device. Fig. 4.



DEVELOPMENT SAMPLE of a low-pressure gas flowmeter. Fig. 5.

mass flow measurement. During a period of 4 weeks this past winter, the data shown in Table 2 were obtained.

Here again we are not certain of absolute standards, but can only compare data between two orifice type of flowmeters and the mass flowmeter. The calibration of the mass flowmeter is based on the average of the two orifice meters over the 4-week period. As you can see, results look very encouraging. This type of meter has indicating accuracies in the order of 1 per cent from a 5 to 100 per cent flow ratio. It should be noted that the rangeability of this servo-operated meter is considerably better than that of the retarding disk type.

A prototype sample of the servo-operated meter is currently being constructed and will go on test later this year. Improved test facilities, which will enable us to more accurately calibrate this prototype, are also being constructed. With this new test equipment it will be possible to get more data to evaluate the inherent accuracy of the meter under widely varying pressure and temperature conditions.

TABLE 2—HIGH-PRESSURE FLOW RESULTS

Week ended—	Lb. west orifice	Lb. east orifice	Lb. mass meter	Per cent difference between orifices	Per cent diff. between mass meter and avg. orifices
February 7, 1956	678,363	676,826	674,500	0.23	−0.46
February 14, 1956	792,340	786,201	793,911	0.78	+0.59
February 21, 1956	749,624	748,483	748,866	0.15	−0.03
February 28, 1956	704,839	700,844	701,484	0.57	−0.19

Acknowledgments

The authors wish to acknowledge the assistance of personnel at Humble Oil & Refining Co., Houston; Black, Sivalls & Bryson, Inc., Oklahoma City; and Cambridge Corp., Lowell, Mass.

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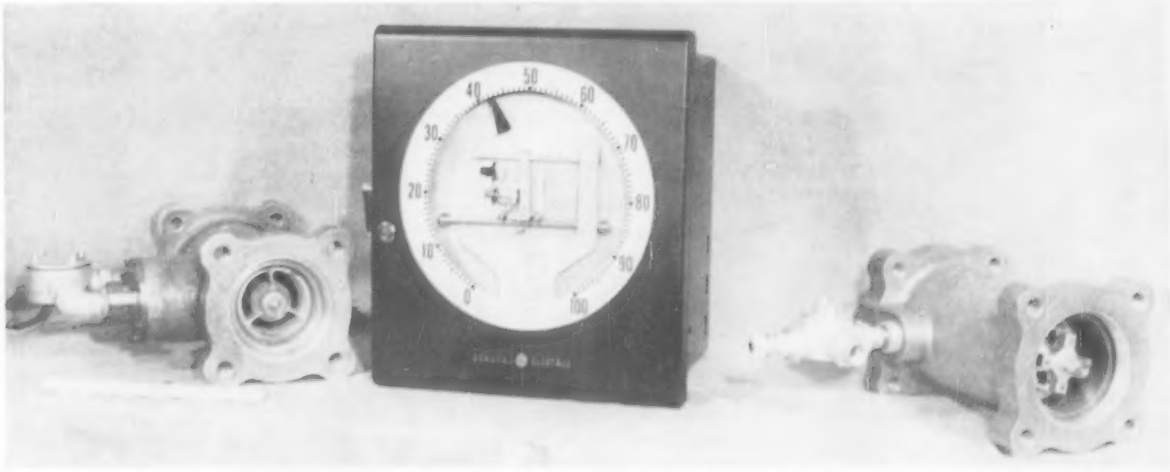


HIGH-PRESSURE gas flowmeter transmitter, receiver, and generator. Fig. 6.

Porosity and Density of Cracking Catalysts

. . . Why they're important and how to measure them by water titration

by W. B. Innes

IN NEW TEST for pore volume, water is added in small increments until the sample does not flow freely on upending.

POROSITY and the related quantity, particle density, are perhaps the two most important physical properties of a catalyst. Porosity affects catalyst stability, stack losses, product distribution, carbon - burning properties, stripping, circulation, and catalyst fluidization.

The ways in which these various operating factors vary with porosity may be determined at least qualitatively. It is then possible to establish permissible porosity variations from these relationships.

Pore volume, a direct measurement of porosity, may now be determined on a routine basis by a new, recently developed method. The method is further adapted to the determination of skeletal and particle density.

Porosity and Stability

Probably most important in a consideration of porosity is its effect on surface-area stability.[1 2 3] Earlier work indicated a linear relationship between log surface area and log time on steaming, stability being characterized by its slope. This slope in turn was found to decrease linearly with the initial ratio of pore volume to surface area, which is a measure of average pore size.

Further data given in Figs. 1 and 2 have confirmed these relationships as generalizations for silica-alumina catalysts, and have shown the dependence on temperature. Little if any difference between high and low - alumina synthetic catalysts have been observed although it should be noted that the former give about 25 per cent higher activity per unit area.

Since the refiner is not interested in stability per se but rather in the relationships between makeup rate and activity level, it is desirable to show they are related.

Assuming the linear log-log relation, Anderson and Mathias[4] have shown that if representative catalyst is continuously withdrawn and fresh catalyst continuously charged at identical rates, equilibrium surface area (A_e) may be calculated by means of the expression:

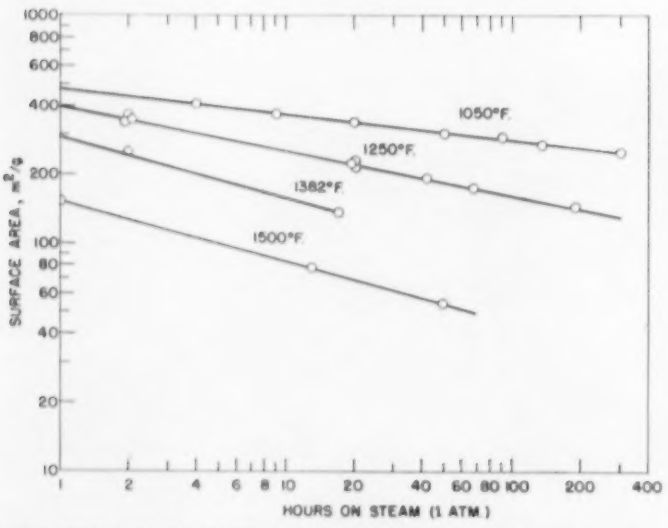
$$A_e = A_1 r^M \Gamma (1 - M)$$

where A_1 is the surface area at unit time, r is the fractional makeup rate per unit time, and M is the slope defined in Fig. 2. The capital gamma refers to a mathematical symbol found in most handbooks.

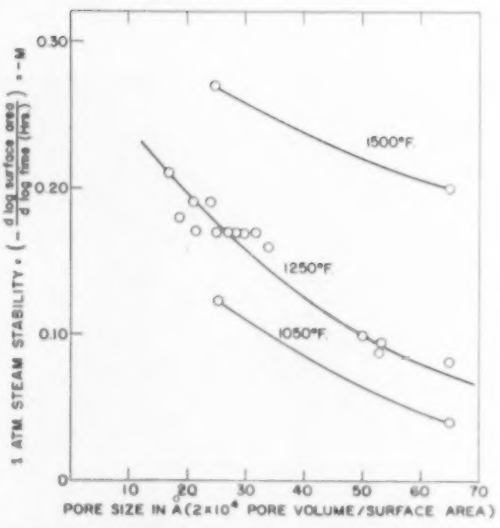
Both the "initial activity constant," A_1, and the stability constant, M, are seen to have a major effect on equilibrium surface area.

Using constants A_1 and M obtained for fresh silica alumina gel catalysts on steaming at 1,250 °F., the plot given

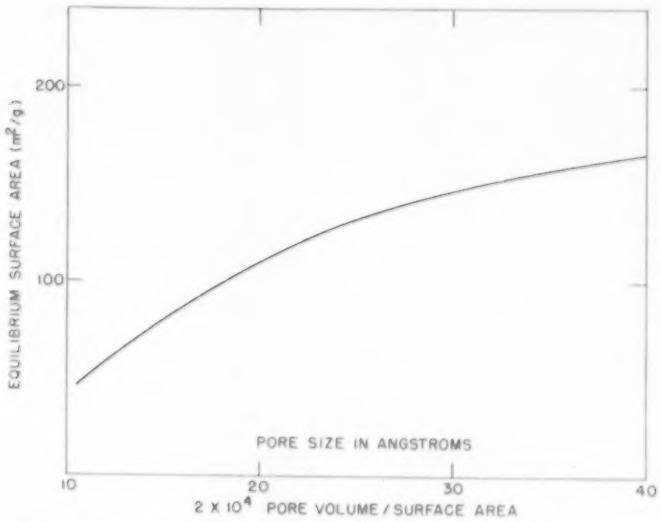
REFINING



REDUCTION IN SURFACE AREA on steaming, at various temperatures. Fig. 1.



STEAM STABILITY at 1 atm., as a function of pore size and temperature. Fig. 2.



EQUILIBRIUM SURFACE AREA as a function of the ratio, pore volume to surface area. Fig. 3.

in Fig. 3 is obtained. Using this relation to calculate makeup for given surface area indicates that a 10 per cent increase in pore size from 25 to 27.5 A would decrease makeup by about 40 per cent.

Since this equation neglects selective stack loss of fresh catalyst and because deactivation conditions are variable and not certain, it would be naive to consider this equation as more than a rough approximation. However, it does not appear far out of line with observations on some commercial units.

Steaming . . . The surface area-pore volume relationship of fresh catalyst on steam deactivation may differ appreciably depending on steam partial pressure and temperature during deactivation. Data obtained by Shell Development Co.[5] are shown in Fig. 4. The position of equilibrium catalyst on such a plot has been found to vary markedly between units and may be related to the cause of deactivation. Based on average data, it appears that normal conditions during commercial deactivation correspond to 750° C. and 0.5 atm. steam.

Temperatures of this magnitude are not normally measured in commercial units but might exist momentarily in particles or local regions during regeneration particularly in the case of fresh catalyst because of high carbon laydown related to its high activity.* Along with other available data, Fig. 4 suggests that if very low pore volume for given surface area is realized for equilibrium catalyst, extremely high local temperatures may have led to unnecessarily rapid catalyst deactivation or unit damage.

In some cases, pore-volume measurements on size fractions are useful for investigating the cause of the deactivation. For example, if it is caused by afterburning in the dilute phase where fines content is high, the small-size fraction will be lower in porosity than coarse fractions.

The work of Wilson et al.[6] has indicated that an appreciable amount of pore space is sealed off during commercial-catalyst usage, thus lowering the apparent skeletal density. Skeletal-density measurement is a useful means of following this type of deactivation which is believed to be effected by high temperatures at low steam partial pressure.

*This may explain the very rapid deactivation rate during the first day reported by Wilson et al.[6] on the basis of tracer studies.

Porosity and Stack Losses

Unless "stack catalyst" activity is higher than that of equilibrium catalyst, economic loss resulting from this cause is minor since to maintain activity level it is usually necessary to make withdrawals. However, sometimes there is a market for equilibrium catalyst, and local air-pollution laws must be considered.

Recent radioactive tracer work by Mitchell and Kinsella[8] on a Cottrell-equipped unit and Todd and Wilson[9] on cyclone-equipped units have indicated that selective loss of fresh catalyst for the units studied was not high. For example, Todd and Wilson report 26 per cent of catalyst added at a particular time was lost in 10 days for the Shell Oil Co. Houston unit. However, stack loss varies widely in commercial units due to variations in unit design, operating conditions, and condition of recovery equipment. Selectivity may vary likewise.

Composition . . . Stack catalyst is comprised for the most part of catalyst just fine enough not to be cyclone retained ($<$20-50 μ). This is derived from fresh catalyst, catalyst worn down to this size, and very fine material (under 10 μ) which is derived from the outside surface of larger particles by attrition. Loss of the larger ($>$20-50 μ) particles from the "cyclone only" units results from elutriation of particles out of the dense phase and up through a dilute phase where hindered settling takes place.

Therefore, this loss can be related in part to Stokes law, according to which the size of particles that will elutriate varies as the inverse square root of particle density. Moreover, particle density has a well-established influence on cyclone efficiency. Porosity has a distinct bearing on particle density, and knowledge of either or both of these catalyst characteristics is of importance to refiners.

Losses due to attrition fines (minus 10 μ catalyst) can be related to particle shape and to particle porosity. A comparison of the attrition loss vs. time of fresh and ground catalyst is shown in Fig. 5. Attrition of ground catalyst in the first 20-30 hours serves largely to wear off the rough edges. The effect of porosity on attrition resistance is shown in Fig. 6. Attrition loss increases approximately linearly with pore volume.

Figs. 5 and 6 represent a composite of numerous data obtained by an attrition test described elsewhere[10] on fresh, heat-treated, and equilibrium experimental and commercial synthetic cracking catalysts of varying degrees of roundness. Although it would be naive to think that attrition could be exactly predicted on the basis of pore volume and particle shape alone, the

THE AUTHOR

William B. Innes is group leader in charge of product research on refinery catalysts at American Cyanamid Co.'s Stamford laboratories. After obtaining his Ph.D. at State University of Iowa in physical chemistry in 1941, he went to work in the paper field with Champion Paper & Fibre Co. and later with American Cyanamid Co. During the war he worked on the Manhattan project under Dr. Williard Libby. He then returned to Cyanamid and has worked in the catalyst field since that time. He is author of numerous papers in the fields of adsorption and catalysis and has contributed chapters to Dr. P. H. Emmett's series of monographs on catalysis.

data indicate that this is a good first approximation. Other factors that have an effect on attrition are particle-size distribution and structural defects in the particles.

Some catalyst attrition is desirable since the presence of a small amount of fines aids in fluidization and circulation, and heavy metals tend to concentrate on the exterior particle surface.[11] For these reasons, some units are equipped with attritors to increase attrition. Elimination of catalyst after it is below equilibrium catalyst activity level and higher than equilibrium catalyst in metals content is, of course, desirable.

There would be an undesirable tendency for catalyst to be retained in a unit longer than its useful life as a result of continuing density increase and porosity decrease with concurrent increase in attrition resistance.

Product Distribution and Porosity

Although pore size may markedly affect selectivity in the case of readily cracked naphthenic stocks,[12] pilot-plant data with Mid-Continent feed stock have not indicated a significant difference between high and low-pore-volume catalyst.[1] Marked effects were noted by Johnson, Kreger, and Erickson[13] when the particle size exceeded 10 mesh, more gasoline and less carbon being produced by large-pore-size catalysts.

Other factors . . . Lower-density higher-porosity catalysts are generally preferred where carbon burning, stripping, circulation, or fluidization is a problem. This can be attributed to one or more of the following reasons:

1. Easier diffusion of air to steam in and hydrocarbons or carbon oxides out of the particles since diffusion depends on porosity.

2. Time of contact of air or steam with catalyst normally varies inversely with bed density since it is usual practice to operate with a constant weight of catalyst.

3. Catalyst "viscosity" is normally less and "fluidity index"[14] higher with a high-porosity catalyst with resultant better circulation and fewer "dead spots."

Pore Volume by Water Titration

Routine sorption methods used today measure microporosity only (volume of pores under ca. 750 A). This limitation and the need for determining macroporosity (volume of pores over 750 A) let to the development of the simple water-titration test.

When liquid is added to an agitated porous powder, the powder usually appears dry and free flowing to a point, after which further small addition of liquid brings about a marked change in its properties. This behavior is readily explained by the fact that the liquid first fills in the pore space, after which the addition of a very small increment effects the same drastic change in properties as observed with nonporous powders.

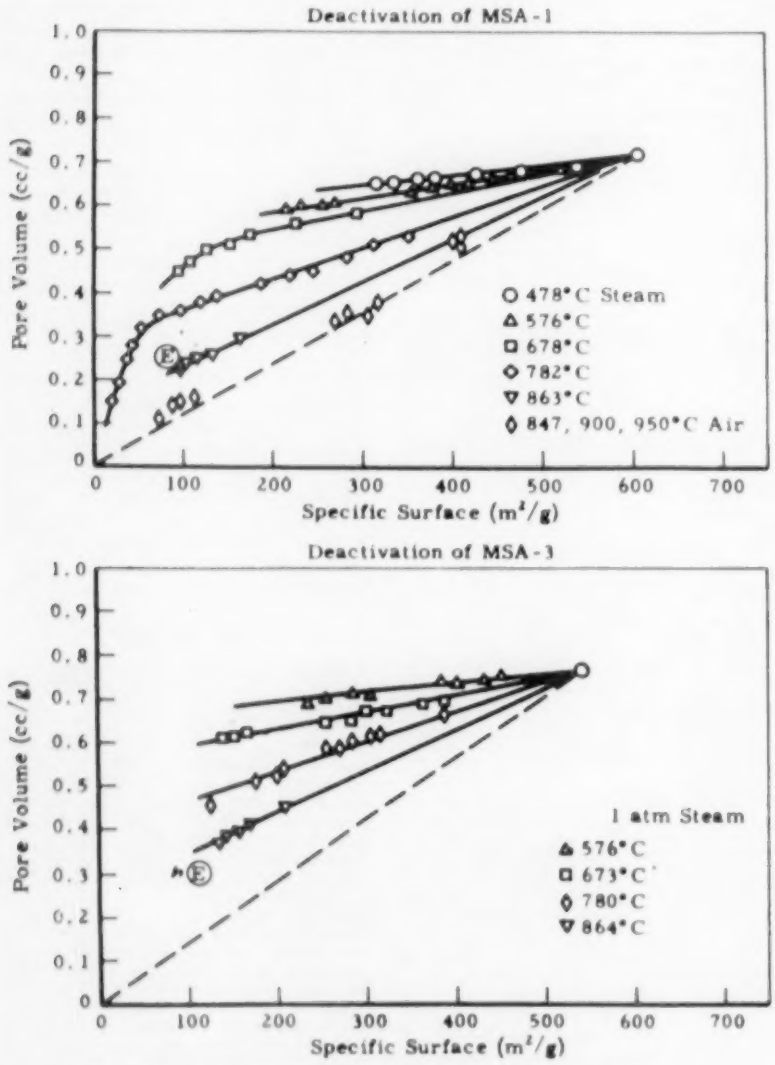
That is, the particles stick together to form a coherent caked mass. This behavior can be attributed to a very thin layer of liquid on the outside of the particles, which makes them stick together because of reduction of liquid-air interfacial surface energy. These phenomena were adapted to pore-volume measurement. Development work leading to the following standard procedure and sources of error are discussed elsewhere.[15]

Procedure . . . Weigh out 25 g. of each sample and transfer to a 4-oz. screw-top bottle (1¾ in. in diameter by 4 in.). (A smaller sample in a smaller bottle can also be used.) It is advisable to run several samples at a time. Add water rapidly from buret in an amount slightly less than the expected pore volume.

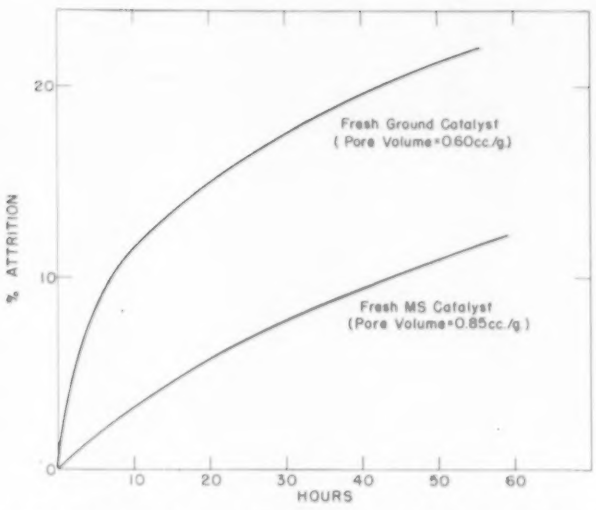
For fresh catalyst with a pore volume of about 0.70 cc. per gram, add 15 cc. and screw on lid. Shake the bottle vigorously for about 20 seconds and cool by holding under a water tap until the temperature is about 25° C. Wipe the bottle dry. Break up any lumps of catalyst with a spatula or by vigorous shaking.

Add water in 0.2-ml. increments. Between additions, break up the lumps with a spatula, then shake vigorously for 15 seconds or more. Rap the bottle against a hard surface several times, then rapidly turn it on end.

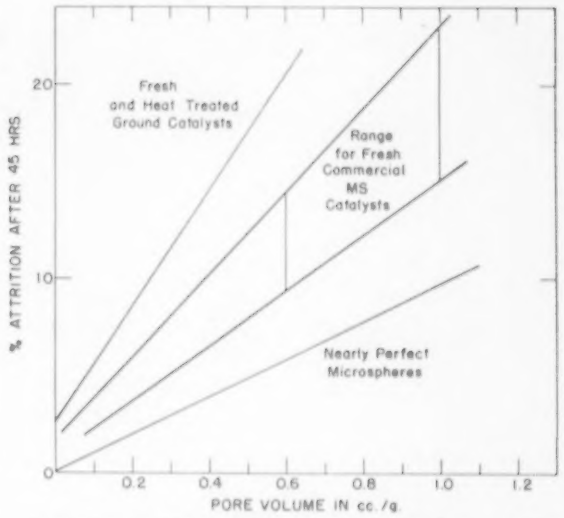
If the sample does not flow freely



PORE VOLUME-SURFACE AREA relationships for fresh catalysts. Fig. 4.



ATTRITION LOSS as function of time for fresh MS and fresh ground catalysts. Fig. 5.



ATTRITION AFTER 45 HOURS as a function of pore volume for various catalysts. Fig. 6.

on upending, the end point has been reached. That is, it sticks to the bottle so as to cover the bottom completely for a period of 2 seconds or more. Repeat the rapping step if results are in doubt. When several samples are run one after the other, the elapsed time is about 15 minutes. If it is shorter than this, check the end point after 15 minutes have elapsed from the start of water addition.

$$\text{Pore volume (cc. per gram)} = \frac{\text{cc. water to end point}}{\text{weight of sample in grams}}$$

Results . . . The method has been applied to many catalyst samples, including used and fresh fluid cracking and hydroformer catalyst as well as some pelleted catalysts (⅛-⅜-in.). Results obtained are compared in Table 1 with those obtained by the conventional nitrogen desorption method.

The comparative results lead to the conclusion that the two methods give values within experimental error on fresh synthetic silica alumina cracking catalysts (standard deviation under 0.01 cc. per gram). Results on equilibrium catalyst and fluid hydroforming catalysts indicate slightly higher values by titration than by nitrogen desorption.

This difference is thought to be due to macroporosity (pores larger than 750-A diameter, which are filled with water in titration method but not with nitrogen in the desorption method). The considerable differences which are observed for pelleted catalysts seem also to result from macropores, consistent with our knowledge of the structure of pelleted catalysts.

TABLE 1—WATER TITRATION VS. NITROGEN DESORPTION PORE VOLUMES

Sample	Pore volume* Titration	Pore volume* Nitrogen
Fresh Silica Alumina Catalysts		
A	0.73	0.71
B	0.79	0.78
C	0.55	0.55
D	0.74	0.74
E	0.61	0.61
Equilibrium Silica Alumina Catalysts		
A	0.18	0.16
B	0.33	0.32
C	0.39	0.38
D	0.35	0.33
Fluid Hydroforming Catalyst (MoO_3-Al_2O_3)		
A	0.30	0.28
B	0.44	0.43
C	0.30	0.27
D	0.28	0.26
Platinum Reforming Catalysts (⅛-in. Pellets) (Pt-Al_2O_3)		
A	0.50	0.29
B	0.56	0.38
C	0.53	0.45
Hydrodesulfurization Catalysts (⅛-in. Pellets) (Co_2O_4-MoO_3-Al_2O_3)		
A	0.62	0.43
B	0.72	0.47
C	0.73	0.48
D	0.40	0.36

*All samples calcined 1 hour at 1,100° F. prior to test. See Reference 9 for nitrogen pore-volume method.

Density Determinations

At the present time, particle density in a gaseous medium is usually calculated from pore volume and skeletal density (density of solid if nonporous), using the following relation:

$$d_p = \frac{d_s}{1 + V_p d_s}$$

Where:

d_p = particle density, gram per cc.
d_s = skeletal density, gram per cc.
V_p = pore volume, cc. per gram

However, both d_s and V_p may be a function of temperature, pretreatment, and the like, which affect water sorption and shrinkage so that use of particle densities calculated from pore volumes and skeletal density obtained under different conditions may lead to error. For example, in determining particle size by the Roller method, the particle density of the wet catalyst from the overhead fraction should be used, whereas the particle density of calcined catalyst gives correct properties of catalyst in a fluid cracker.

Also recent work of Wilson et al.[6,7] has indicated that apparent skeletal densities decrease with catalyst usage because of blocked pores so that assumption of a constant value may not be justifiable for used catalyst.

To correctly measure particle density, the sample is first tested for pore volume. Then more water is added to form a slurry and the sample is transferred quantitatively to a volumetric flask or pycnometer of known volume and tare (100 ml. is suitable for a 25-g. sample).

The bottle is then filled and accurately weighed and the temperature of the mix is measured. To eliminate entrapped air, the bottle should be subjected to a swirling motion or brief evacuation prior to complete filling.

Particle density can be calculated as follows:

$$d_p = \frac{\text{sample weight}}{\text{flash vol.} - \frac{\text{final wt.-tare wt.-sample wt.}}{\text{water density at temperature}} + \text{vol. added to pore vol. end point}}$$

Skeletal density is given by:

$$d_s = \frac{\text{sample weight}}{\text{flash vol.} - \frac{\text{final wt.-tare wt.-sample wt.}}{\text{water density at temperature}}}$$

TABLE 2—DENSITY VALUES BY WATER TITRATION TO PORE VOLUME AND FIXED VOLUME END POINTS

Fresh Silica Alumina Catalysts*

Sample	Pore volume (cc. per gram)	Particle density (gram per cc.)	Skeletal density (gram per cc.)
A (MS-13per cent Al_2O_3)	0.68	0.92	2.45
B (MS-13 per cent Al_2O_3)	0.80	0.83	2.46
C (Gnd.-13 per cent Al_2O_3)	0.51	1.08	2.43
D (MS-25 per cent Al_2O_3)	0.66	1.10	2.49

Equilibrium Silica Alumina Catalysts*

A (13 per cent Al_2O_3)	0.35	1.24	2.19
B (23 per cent Al_2O_3)	0.39	1.20	2.30

*All samples calcined 1 hour at 1,100° F. prior to test.

Illustrative data are given in Table 2. It should be noted that equilibrium catalysts have significantly lower skeletal density than fresh, in accordance with the observation of Wilson et al.[6]

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BOOKS

GEOLOGY OF THE TURNER TURNPIKE, GUIDEBOOK LV. Published by the Oklahoma Geological Survey, Norman, Okla. 76 pp.

For the first time, a guidebook of the geology of the Turner Turnpike is available to Oklahoma geologists. In addition to the road log and geological data, here are several articles on the local and regional geology. The book is well illustrated and will be a very valuable asset to anyone interested in the geology of northern Oklahoma.

INDEX LIST OF EARLY WESTERN KENTUCKY WELL RECORDS by Daniel J. Jones. Published by Kentucky Geological Survey, 120 Graham Avenue, Lexington, Ky. 277 pp. $3.00.

This compilation is an index of logs of approximately 14,500 well records, principally from western Kentucky. The index is a result of more than 4 years of effort.

These well records are in the microfilm files of the Kentucky Geological Survey at Lexington. They are open for inspection at any time.

IMPORTANCE OF BIOLOGICAL RESEARCH IN INDUSTRIAL MEDICINE by Paul Gross, M.D., Helmuth H. Schrenk, Ph.D., and C. Richard Walmer, M.D. A reprint from The Journal of American Medical Association. Available without charge from Industrial Hygiene Foundation, Mellon Institute, 4400 Fifth Avenue, Pittsburgh 13.

This article lists symptoms, signs, organs, or systems affected and diagnostic laboratory tests relating to some commonly used toxic substances.

STRUCTURAL GEOLOGY, by L. W. de Sitter. Published by McGraw-Hill Book Co., 330 West Forty-second Street, New York 36. 552 pp., $8.

The author of this advanced text on structural geology, a distinguished Dutch geologist, draws on an exceptionally wide, practical experience in order to establish a much needed link between theory and practice of orogenesis. The book is intended for the trained geologist rather than the layman or even the undergraduate student. The author presupposes that the reader has a certain familiarity with the elements of structural geology and with its terminology. The book deals in considerable detail with comparative structural geology, proceeding from the simple to the more complex structures. The comparative method of illustration predominates throughout. The book is exceptionally well illustrated, with 309 figures. The author successfully correlates theory, experiment, and actual cases.

COMMERCIAL WAXES edited by H. Bennett. Published by Chemical Publishing Co., Inc., 212 Fifth Avenue, New York 10. 688 pages. $15.00.

An up-to-date enlarged and revised edition of a successful book with much additional information on natural and synthetic waxes, wax blends, and wax-resin compositions.

Mineral, vegetable, animal, synthetic and compounded waxes are covered in detail. A substantial part of the data has not been published before and the balance has been compiled from many different publications.

Over 160 tables list data on the physical and chemical properties of waxes, such as melting point, specific gravity, hardness, purity, fracture and form, moldability, adhesiveness, solubility, penetration, etc.

More than 60 graphs show the relationships of physical properties, effects of adhesives, etc.

THE ECONOMIC GEOLOGY OF CRAWFORD, MARION, MORROW, AND WYANDOT COUNTIES by John F. Hall and Robert L. Alkire. Published by Ohio Division of Geological Survey, Orton Hall, Ohio State University, Columbus 10. 43 pp. $1.00.

These counties are located in the central and north-central part of Ohio. This report gives a description of the bedrock, a history of the oil and gas drilling activity plus a discussion of other economic minerals including limestone and dolomite, sandstone, sand and gravel, and clay.

THE GEOPHYSICAL DIRECTORY, 1956. Published by the Geophysical Directory, 2200 Welch Avenue, Houston 19. 389 pp., $4.

This is the eleventh edition of this comprehensive directory of the geophysical industry. It contains a very complete list of companies engaged in the exploration end of the oil business. In addition, it contains a directory of all geophysicists as well as some geologists and executives who are connected with the geophysical exploration of petroleum. Oil companies who have used geophysical services in the past year are also listed.

CRITERIA FOR PROFESSIONAL EMPLOYMENT OF ENGINEERS. Published by N.S.P.E., 2029 K Street, Washington 6, D. C. Paper cover, 23 pp., 25 cents.

Printed in check-list format, the criteria cover specific categories of engineering career development. The criteria suggest the responsibilities of the employer to his professional employes and the latter's responsibilities to the employer.

Topics included are: recruitment, indoctrination, professional development of the individual, salaries, engineering titles, personnel practices, and termination policies.

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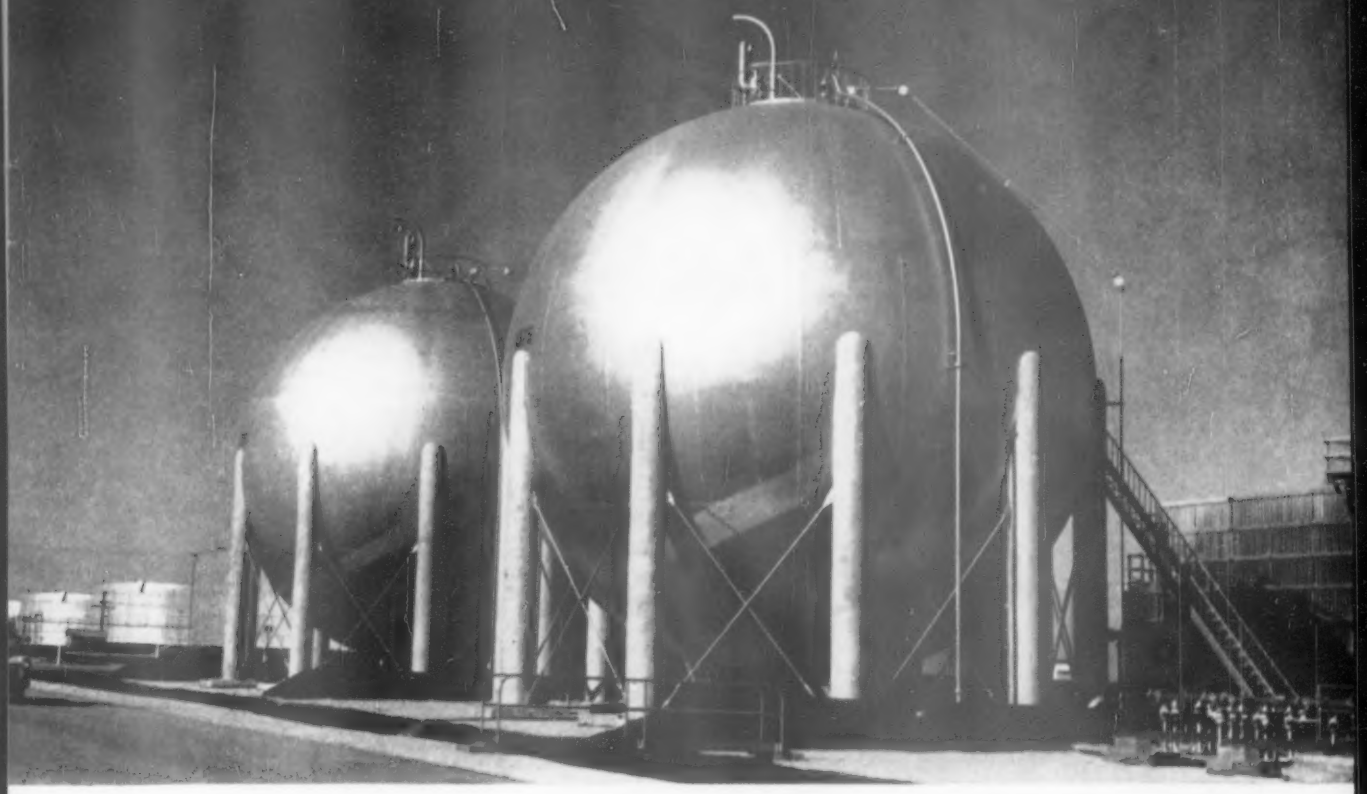

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by H. C. McDaniel

IT IS necessary for a technical author to master only a few fundamental writing habits before his work becomes readable and conveys the intended message. However, to become a published author requires additional work—but not as much as you might imagine.

Before continuing, it will help any author to know the definition of a technical article. It is a piece of prose, the basis of which is factual. It aims to inform, instruct, persuade, or a combination of these. A technical article is the result of sustained effort in gathering material, thinking it through (outlining), and finally writing.

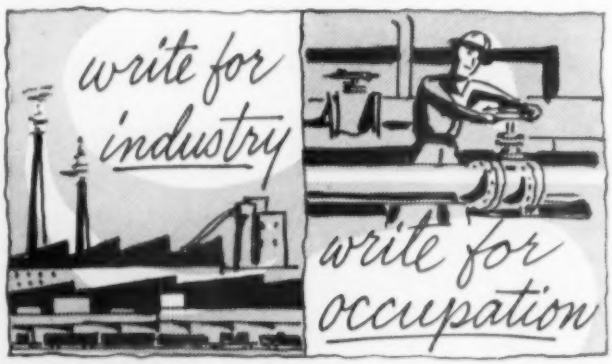
A technical article is but one of the communication devices that can be used to transmit information or impart ideas from one mind to other minds. To achieve its objective, such a piece of prose must have a specific purpose, and a specific audience. Here then is the key to successful writing. A technical article must have a specific purpose and a specific audience.

Aims and purpose . . . Now that you know what is meant by the term, technical article, it will be easier for you to learn how to write such articles for publication. How to gather information, how to organize it, and how to present it will determine your article's acceptability to the magazine.

To do this efficiently and successfully, first you must know the aims and purposes of the magazine and what it's trying to accomplish editorially. Then you must know who the readers are, and what they do.

For any given magazine, there is a specific answer to its aims and purposes. One editor reports the purpose of his magazine is: "To help the industry increase its productivity." But, you're not dealing with a specific magazine, rather you're dealing with a species—all magazines that publish technical articles. And, as you might suspect, magazines follow the usual pattern of a species in that all members are not exactly alike.

In the case of technical magazines, they differ in two important respects: One group is concerned solely with the problems of a specific industry, such as that of aviation, chemical, or electrical, and therefore, publishes only information of interest and use to the industry. The other group is concerned solely with a specific job function, such as that of product design, production, or maintenance, and therefore, publishes



Know your readers' interests, and slant toward them!

Author is manager of technical information, Westinghouse Electric Corp., Pittsburgh. Paper presented at the Conference on Scientific and Technical Writing, Philadelphia, August 20-24, 1956.

only information pertinent to that professional occupation.

But, regardless of this species distinction, it may be said generally that all magazines that publish technical material, do this "to help the reader do his job better."

This is accomplished editorially in one of the following ways:

1. Reporting important new technical information.
2. Reporting practical, down-to-earth, how-to-do-it applications of technical information that lead to new or improved methods of operation.
3. Reporting new process techniques or technical developments and interpreting the benefits of each.
4. Keeping open the lines of communication among members in the industry.

Such emphasis on the editorial keynotes of utility and purposefulness is your clue to the kind of information to look for when you select material for your article.

If you desire what you write to be published, write for the reader of the magazine; and as you do, be very sure that what you write is of real professional use to him.

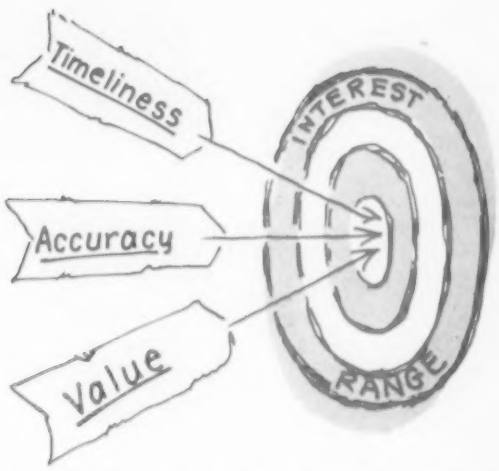
You must never forget that technical magazines are published solely for the professional needs of their readers, therefore, the editor is interested only in information that satisfies these professional needs.

Readers of technical magazines . . . The people you write for, the readers of technical magazines, are men in business, trade, and industry. Every professional occupation is represented: policy and administration, accounting and finance, purchasing and production, research and development, engineering and design, sales and service. Some of these men have college degrees, some do not. For those who do, they range from Ph.D. and M.S. to B.S. and B.A. For those who do not, their professional experience is their forte.

But, irrespective of the professional needs of a man—or his education background—there is a magazine that caters to these needs, and this is true regardless of the degree of specialization of his work. Readers of technical periodicals represent a cross-section of the spectrum of job classifications regardless of the industry.

For our purpose, it is not practical to be more specific about readers of technical magazines. While a great many "for instances" could be cited, such would serve no useful purpose here. More useful is the knowledge that in the Business Publications Rates and Data Volume of Standard Rate & Data Service, Inc., you can find a numerical distribution of readers by job classifications for each of the more than 2,000 such periodicals that serve 125 businesses, trades, and industries in the United States.

There is also included a numerical distribution of readers by geographical location. If the public library doesn't have S.R.D.S. in its periodical room or at the business branch, you should be able to find a copy in the advertising or public-relations department of any large corporation, or in the library of an advertising and public-relations agency.



Editors have to be specialists in gathering material readers want, and then presenting it in such a way as to spark and hold interest. Always the editor asks himself: is it relevant, has it reader value, is it new, or timely? Work with the editor. He'll give you some valuable tips.

Selecting technical articles . . . Though the article you write is aimed at a specific reader, this in itself will not assure publication. The manuscript still has to fulfill the editorial requirements of the magazine and must benefit you as the author. Meeting the editorial requirements usually includes a number of concepts that are almost always headed by the relevancy or reader-value concept.

. . . Relevancy. Where relevancy is concerned, the editor usually asks: Is it in our field? Is it germane to the industry we serve? Is the material relevant to our editorial program? Or, does the subject matter fall within our editorial scope?

The philosophy of relevancy goes about like this: It doesn't do anybody —the reader, the publication, the author or a company—much good to have an article appear where it doesn't reach the greatest number of people interested in the subject and the particular treatment of the subject.

. . . Reader value. When the manuscript is being tested for reader value, the questions go about like this: Is the subject of interest and value to our readers? Is the material of significance to our readers? Does it give them new, additional, or different information about an older subject? How much new, unusual, and interesting information does the manuscript contain for our readers? Is the information of immediate practical value? Will it help our readers? Does the article define or solve a problem? Will the technique or development be directly useful to our readers?

This is a key question. Its origin stems from the fact that the technical magazines have built their reputation over the past decades on the usefulness of their editorial content and today more than ever they must adhere relentlessly to this concept for their readers are people who must put their knowledge to good use in solving everyday problems.

. . . Timeliness. This is another concept of great importance. Is it new? Does the manuscript describe a new technique or development of significance to the industry we serve? Does the article deal with a problem of current interest? Is the material fresh, or is it something that's been hashed into a general across-the-board release? Or, is it new or newsworthy?

The underlying thought here is this: Progress is paced by development; development of new materials and machines, processes and techniques, therefore, if the technical magazine is to serve the professional needs of its read-

ers it must bring them the latest on developments not something that is already known throughout the industry.

. . . Interest range. An exretmely useful concept at times is interest range. How many readers will be interested? Can the material be presented to attract the attention of a fair share of our readers? Does the article approach the subject from the angle of greatest interest and usefulness to our readers? Is the subject of broad interest? Will the information be of interest to a wide range of our readers? Or, is the material too specific for our audience?

The philosophy here is one of maximum value for the greatest number of readers. That's usually a basic yardstick of all magazines. No publication can afford to publish an article that will attract only 3 per cent of its readers when it already has waiting for publication an article that will draw the attention of 75 per cent of its readers.

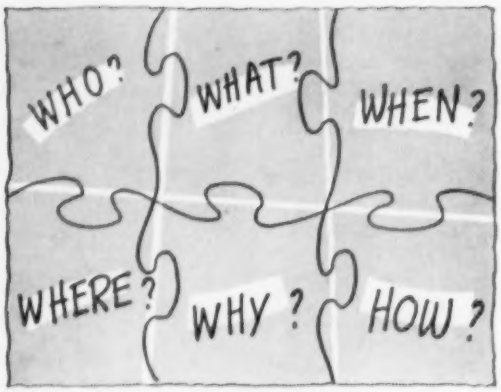
. . . Accuracy. An extremely important concept is accuracy. Are the statements supported by facts? Is the information accurate? Is the article accurate, factual, impartial? Or, does the article contain facts—does it say something specific?

Technical magazines have a major obligation to their subscribers to make certain that nothing that is printed will mislead them. Claims must be backed up by facts. Any unusual statement must be so well explained and supported by facts that readers will accept its veracity. Readers are interested in facts far more than in claims.

. . . Authoritativeness. In a way, authoritativeness is associated with accuracy, yet it isn't. Is it authoritative? Or, is the author an authority in the field he is discussing? This concept is directly related to the line of reasoning that goes something like this: to write intelligently, you must first of all be familiar with your subject. Until you are, the wisest course is to gain experience.

. . . Duplication. Manuscripts must on occasion be tested for duplication. If this is not a new process or technique, does it add to the literature? Or, does it complement or duplicate material recently published or planned for future publication? Being the antithesis of newness, no editor is going to jeopardize his reputation for being there first with the newest by accepting material that is old.

Other matters to check for are: completeness—does the manuscript contain all essential information needed to present the technique or development? Then there is structure—is the manuscript well organized? Does it follow the progression of cause and effect? Is the information presented in a clear and terse manner? And finally, there are visual aids—do illustrations support the central theme of the article?



"Picture your article as a jigsaw puzzle. In the lead paragraph you give the reader a fast look at the completed puzzle. He gets an idea of what the whole picture looks like. Then, in effect, you take a duplicate of the puzzle, and assemble it, piece by piece, before the reader's eyes."

The feeling of all editors on these points are strong. They do feel, for instance, that the manuscript should be complete. However, many of them admit that if the article is on a subject they want to cover, they will go back to the author for more information rather than reject the story completely. On structure or organization, this is their reaction: It isn't often that an article will be turned down solely because of faulty organization or style.

Editors are far more interested in content than in style, for usually a considerable reorganization and restyling job is done anyway. That's just part of their daily jobs.

Often, though, the editor does insist on changes that will shorten articles, liven them up, make them easier to read and to understand, broaden their appeal, sharpen their approach.

While most editors are more interested in subject matter and content than in niceties of style, the fact remains that a well-organized, well-illustrated, and tersely written article will get prompter consideration and will be published sooner than one that is a hodgepodge of organization.

Benefits to author . . . You gain more professionally and personally through the technical articles you write than any other person. There is no surer nor easier way to establish a professional reputation than by publishing useful, well-prepared, and authoritative articles that get the serious attention of people in your field; your name becomes a part of their vocabularies.

You get personal recognition in your own company, too, among your immediate associates as well as those above.

You'll find, too, that the discipline of writing forces you to rigorously organize your thoughts and your data. This, in turn, can lead to brand-new ldeas, concepts, or explanations.

Then there's another benefit, the greatest of them all: The keen, lasting personal satisfaction of knowing you're passing along information that will help engineers everywhere do a better job now and for years to come. It's this willingness to share know-how information that has made United States engineers and industries the world's most progressive.

Finally, there is the honorarium. Sometimes this is in cash, sometimes in reprints. Generally, but not always, the choice is yours. This honorarium can never come anywhere near compensating you for your specialized knowledge or experience, nor probably even for your time in preparing the article. But it does represent supplemental income and for this reason should be of some interest.

Suggestions to authors . . . There are several ways editors can help you as authors and as suppliers of technical information. And the vital key to all of them is to get in touch with the editor early—directly or through your public-relations department.

From necessity, editors have to be specialists in two things: Types of editorial material their readers want, like, and use; and, ways to present this material so as to spark and hold interest. Therefore, the sooner you start working with the editor, the easier it will be for him to pass along his tips.

The moment you begin thinking of writing an article, let the editor of the magazine you think will be interested know something about it before you

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start the serious work on the article.

If convenient, drop in and see him. If you can't do this, send him a short outline of what you have in mind and how you intend to treat it. Then he can let you know at once whether he is interested.

This might save you a lot of work. Your article idea may be a perfectly good one, yet more suitable for some other publication. Or, it just may be the editor already has on hand a manuscript along the same lines. In either case, it would be to your advantage to know right at the start that the magazine couldn't publish your material.

There's another way you can profit by getting in touch with the editor early in the planning stage of your article. He can often tip you off to some of the tricks of the trade that'll get better attention for your story.

One of the first tips he'll give you is this: The reader wants to know two things immediately:

What's this about?

Why should I read it?

This information should be in the first paragraph of the story, therefore, summarize the theme of your article in this paragraph. If the reader goes on, he has only one more question: Where is the proof?

Ideally, the technical article does not stray from this pattern. If, as you develop your story, you have doubt about the value of a paragraph or a page for this reason, drop it. Better that you do it than for an editor to have to suggest it. Don't be afraid that a manuscript is too brief. Depend as heavily as you can on graphic illustrations to carry your message, but keep the charts, graphs, and tables simple.

The reason many look upon writing as an ordeal is that they are not prepared to write. Writing is nothing more than disciplined thinking, and until your thoughts are crystallized, you'll have difficulty putting them down on paper. Here are some things you can do that may help you:

Talk over the subject of your discourse with others. In so doing, you'll be forced to organize your thinking to express yourself; to answer questions.

Start writing even though you do not feel prepared. By the time you reach the second or third page, you'll hit upon the key to the puzzle. Stop right there. Tear up what you have written. Start where you should have in the first place.

If you absolutely cannot get started, sleep on your story. The pieces often fall into the right place the next day.

If you are one of these unfortunate persons who have trouble writing because words get in your way, you should study writers like Flesch and Gunning. Three points they make are fundamental: Write as you would like to talk; keep your sentences short; and use simple words. The simplicity of the thought, not the number of words in a sentence should govern.

Then there is the matter of grammar. Many rules (like the split infinitive or preposition at the end of a sentence) have nothing to do with meaning. They are mere matters of form. They often get in the way, make a thought hard to express. Not only that, the product is stilted. A stand taken by many editors is this: If the rule of grammar goes to substance, is necessary to understanding, it should be followed. If it is a matter of form, break it if it gets in the way.

And on organization, here is a viewpoint that might help. Picture your article as a jigsaw puzzle. In the lead paragraph you give the reader a fast look at the completed puzzle. He gets an idea of what the whole picture looks like. Then, in effect, you take a duplicate of this puzzle and assemble it, piece by piece, before the reader's eyes. Because he already has a notion of what the picture looks like, you must not confuse him or throw in pieces that do not fit. The pieces must go into the right places and in the proper order.

This means you must be logical; one thought must flow logically into the next, which gets back to what has already been said: writing is disciplined thinking.

Adapting Technical Reports to Technical Articles

The first and most important step to decide when using a technical report as the factual basis for a technical article developed in the usual fashion is to decide the general nature and purpose of the essay. This will determine what parts of the report are to be used and what reorientation may be required. Once the nature and purpose of the article are decided it should be possible to rough an outline and select illustrative material.

You must keep in mind this fact: the reader of the technical magazine is interested in the results and the application of the results, therefore, your article need not be as exhaustive or detailed as your paper. In fact, it will not be accepted for publication if it is.

This means you must remove the generalities and historical background and similar extraneous material that do not support directly the purpose of your article. You must bring it down to earth in terms of the reader's immediate job interests. To do this, you should present the facts in as simple and straightforward a manner as possible.

Should you not wish to do this adaptation without some help and guidance, query the editor about the feasibility of adapting your technical report to a technical article before beginning work on it. But don't just send him a copy of the report. Whenever possible, send along a brief explanation or outline of what you propose to do.

One final point to remember: the illustrations in the report may be quite dead looking and for this reason may have to be retaken for the article presentation. If this is the case, tell the editor what you are in a position to do in this respect. Also, summary tables may have to be prepared to replace a lot of detailed tables. Suggest how you plan to handle this. In other words, make it easy for the editor to grasp the story idea, don't make him dig for it.

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Roger W. Bolz, editor, Automation, Penton Building, Cleveland.

J. R. Custer, editor, Automotive Industries, Chestnut and Fifty-sixth streets, Philadelphia.

J. R. Callaham, editor, Chemical Engineering, 330 West Forty-second Street, New York.

Ivan A. Given, editor, Coal Age, 330 West Forty-second Street, New York.

P. J. B. Stevens, editor, Design News, 3375 South Bannock, Englewood, Colo.

D. L. Hemmenway, senior associate editor, Electric Light and Power, 22 East Huron Street, Chicago.

N. H. Jacobson, editor, Industry Report Issue, Electric Light and Power, 22 East Huron Street, Chicago.

Fischer Black, editor, Electrical World, 330 West Forty-second Street, New York.

Edward E. Grazda, editor, Electronic Design, 19 East Sixty-second Street, New York.

W. W. MacDonald, executive editor, Electronics, 330 West Forty-second Street, New York.

Walter J. Murphy, editor, Industrial & Engineering Chemistry, 1155 Sixteenth Street, N.W. Washington, D. C.

David A. Glenn, editor, Industrial Laboratories, 201 North Wells Street, Chicago.

R. L. Stedfeld, associate managing editor, Machine Design, Penton Building, Cleveland.

H. R. Clauser, editor, Materials and Methods, 430 Park Avenue, New York.

William Bradbury, editorial director, Mechanization, 1120 Munsey Building, Washington.

Robert H. Wilcox, managing editor, Mill and Factory, 205 East Forty-second Street, New York.

A. W. J. Dyck, editorial director, Paper Industry, 431 South Dearborn Street, Chicago.

John C. W. Evans, editor, Paper Trade Journal, 15 West Forty-seventh Street, New York.

R. L. Marinello, managing editor, Plant Engineering, 110 South Dearborn Street, Chicago.

L. N. Rowley, editor, Power, 330 West Forty-second Street, New York.

George F. Nordenholt, editor, Product Engineering, 330 West Forty-second Street, New York.

Harry Chandler, copy editor, Steel, Penton Building, Cleveland.

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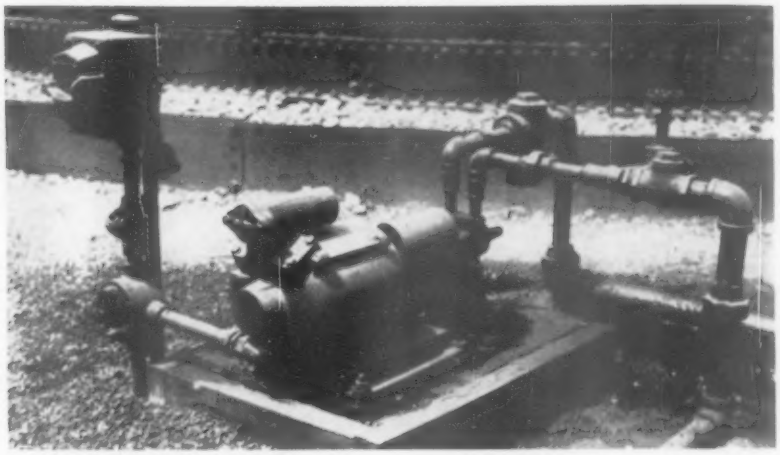


TYPICAL MOTOR-DRIVEN PUMP UNIT for recycling tank bottoms. A strainer is incorporated upstream from the gear-type pump.

Tank Bottoms Are Recycled

System is automatic in operation; saves time and oil

by D. H. Stormont
District Editor

A SYSTEM for recycling stock-tank bottoms back to the wash tank is providing numerous benefits at 50-odd Shell Oil Co. tank batteries in the Los Angeles Basin area.

Since water is continuously bled from the stock tank while it is filling, the tank can be gaged, sampled, and shipped immediately. There is no time delay while the pumper opens the sump line and bleeds off the bottom water.

There also is a saving in oil. Most pumpers keep the drain valve open long enough to assure that clean oil is flowing—and usually a little longer just to make doubly sure. The method also is beneficial in that water withdrawn through the wash-tank weir box is not contaminated with oil in the sump.

Two probable benefits are reduced tank-bottom corrosion and treating costs. Since clean crude is in contact with the tank bottom, instead of water, corrosion should be lessened. Less chemical probably is needed since some should remain in the water and crude circulated to the wash tank.

Effectiveness of the method is best shown by its performance. Of the hundreds of tanks of crude which have been shipped, none has had to be retreated before shipping. All have been well within the 3 per cent maximum water cut.

How it works . . . The diagram shows schematically how the automatic bleeding system is installed. Equipment and piping are sized so that about 10 per cent of the oil production going into the stock tank is circulated. Systems vary in size from about ½ g.p.m. (17 bbl. per day) to 20 g.p.m. (685 bbl. daily). At the average installation the volume circulated is about 1 g.p.m.

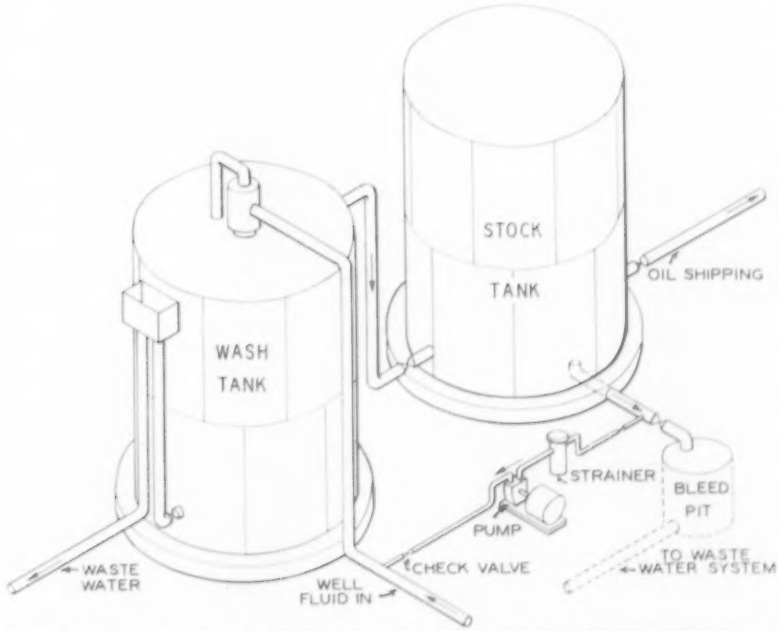
Nearly all are installed at batteries which have been in operation for years. Most of these are comprised of the wash tank and a single storage tank; production is held in the wash tank while the stock tank is being shipped.

The recycling line usually is 1-in. pipe. This is reduced to ½-in. at the intake to the gear-type pump, which is driven by a ¼ or ⅓-hp. electric motor as shown in the accompanying photo. Where waxy crudes are handled, oversize lines and pumps are used.

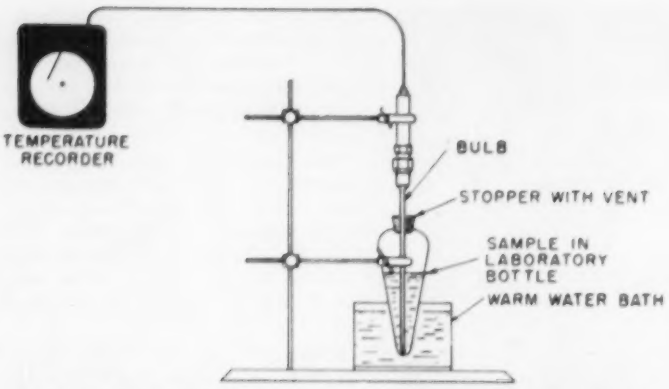
A strainer in the intake line keeps out any debris, while a check valve in the discharge line prevents any backflow. As the equipment is set inside the fire wall, explosionproof motors are used.

The pump operates continuously while the tank is filling. After it is full and ready for shipment, the pumper checks to see if the pump is operating. Likewise he will open a drain cock in the line to determine, using the "thumbnail" test, if clean crude is being circulated. The pump then is shut down while the tank is being shipped.

Shell is using this tank-bleeding method at two automatic-custody-transfer systems in Brea field. Fee production is shipped through a Shell-owned pipeline to a Shell-owned refinery. As positive-displacement meters are used for volume determination, oil production is continued into the tank during shipping. Likewise recycling of bottoms to the wash tank is not interrupted.



SCHEMATIC SKETCH of how Shell incorporates the automatic stock-tank bleeding system at its Los Angeles Basin tank batteries.



RESISTANCE-TYPE RECORDER is used with boilaway apparatus. Fig. 1.

Boilaway Recorder Eliminates Guesswork

by W. H. Dudley

WHEN contract specifications on butane and propane call for something better than an L.P.G. mixture, the open-cylinder method of boilaways is inadequate. While the open-cylinder method is generally accepted, everyone is familiar with its disadvantages.

It is necessary that we maintain specifications very closely so we installed a boilaway recorder. This has eliminated all the guess work in boilaway testing.

Installation and Testing

A resistance type of recorder was installed (Fig. 1). A range of plus 70°-0°-minus 70° F. was selected in order to cover the initial boiling point and end point of propane and the mixture of iso and normal butane.

The resistance bulb used with the recorder is the tip-sensitive type so that the temperature of even the last few drops of the sample are accurately recorded. A standard 100-ml. vented laboratory bottle with stopper, clamp stand, and water bath are the only additional equipment.

In the testing procedure, the lab bottle and bulb are chilled with the product to be tested. After chilling, three pieces of activated charcoal are added to the bottle and 95 ml. of sample drawn. Insertion of the bulb into the bottle should be handled with care, since erratic results will be recorded if the bulb rubs the wall of the bottle. If the sample is butane or a butane mixture, it is then placed in a water bath in order to speed up the boilaway time. In testing propane, the water bath is not used.

The preparation of the sample requires only about 60 seconds. Within a few minutes the operator has a permanent record of the products tested (Fig. 2).

This instrument requires very little maintenance. It has been in continuous service since May 1952. After 3½ years, the tubes were replaced, and occasionally a fuse is replaced. The total cost of the instrument and installation was $437.

Results

In order accurately to interpret the results of the boilaway recorder, we must consider the route of the raw feed flow and the points where the various cuts are made. In our plant the raw feed flows into the deethanizer where ethane and other undesirables are carried over the top.

From the bottom of the deethanizer the flow continues to the depropanizer where the propane cut is made from the top. From the depropanizer bottom the flow continues to the debutanizer where the isonormal mixture is cut from the top.

Contract specifications usually include the desired vapor pressure and the amount of contamination allowed in the finished product. Propane of 175-psig. vapor pressure allows very little if any contamination. In order to maintain this vapor pressure our recorder must record an i.b.p minus 43° and an e.p. of minus 43°.

Tests 3 and 4 of Fig. 2 indicate that the propane is on specification. Tests 1 and 2 indicate that the vapor pressure is dropping since the initial boiling point is a minus 42° and the end point is a minus 40°. From the two consecutive drops in the initial and end points, the operator knows that he must lower the heat of the deethanizer bottom to restore the initial boiling point to a minus 43° and lower the heat on the depropanizer bottom to restore the end point to a minus 43°.

Tests 1 and 2 also indicate that we have from 0.5 to 1 per cent isobutane contamination in the propane. Tests 5, 6, and 7 indicate that the isonormal mixture is on specifications or has a vapor pressure of 49 psig. The composition of the isonormal mixture is maintained only as long as the purity of the propane is maintained.

The boilaway recorder has paid for itself many times over. It was obtained from Foxboro Co.

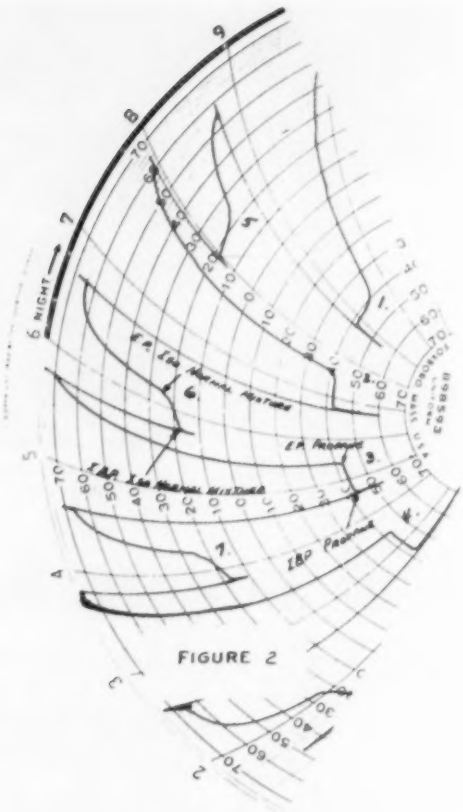


FIGURE 2

PERMANENT RECORDS of the products tested are made by the recorder. Fig. 2.

Author is plant engineer, Southern Minerals Corp., Bishop, Tex.

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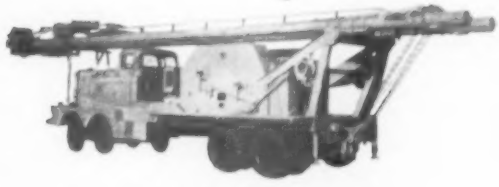

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MAINTENANCE—Today's Top Challenge

In many petrochemical plants workers assigned to upkeep outnumber those engaged in the production function. The reason? The influences of mechanization and automation

by P. S. Skaff

AN analysis of the maintenance function in modern and complex industrial plants of today will reveal several trends of marked significance. Let's consider some of the more important ones.

1. The portion of the cost-of-production dollar attributable to the maintenance of the plant is growing at a faster rate than are other elements of cost.

2. Another important trend is that of the influence of maintenance techniques upon the quality of the product. Contamination due to factors like inadequate containment, excessive lubrication, and poor mechanical workmanship and housekeeping is becoming increasingly intolerable.

At high process rates one occasion of contamination can degrade thousands of dollars of process material to waste. And of course, protection from contamination becomes increasingly difficult as process pressures reach levels only dreamed of 10 years ago, not to mention the many severe mechanical problems that come with superpressures.

3. Operating investment per employe has risen markedly in the last decade. For example in du Pont, today's investment per capita has almost doubled in the 10-year postwar period, and runs at the high level of $24,000.

Author is mechanical superintendent, E. I. du Pont de Nemours & Co. at Orange, Tex. Presented at A.S.M.E. petroleum mechanical engineering conference, Dallas.

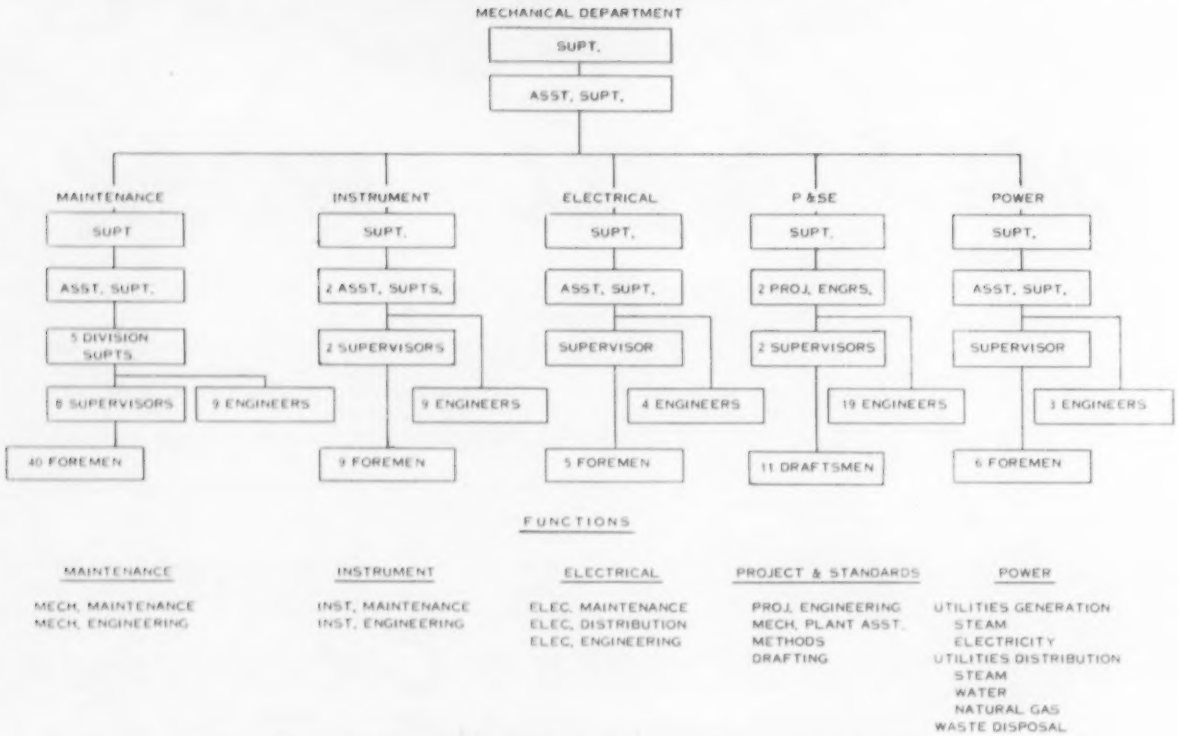
PETROCHEMICALS

The increase of equipment per employe means increased use of automatic control; and of course these automatics must be kept in perfect order to do their job. This demands intelligent and adequate maintenance, applied in such a way that a minimum of process down time is necessary.

An appreciation of the magnitude of this phase of maintenance can be obtained from a couple of statistics applying to the Sabine River Works of the du Pont company. Over 10 per cent of the operating investment at this site is in instrumentation and control, and 15 per cent of the mechanical force is involved in its maintenance.

Sabine River Works

Our plant is on the Sabine River near Orange, Tex., and covers a site



MAINTENANCE ORGANIZATION at du Pont's Orange, Tex., petrochemical plant. Fig. 1.

of over 1,000 acres. The first major postwar plant of the du Pont company, we are now only about 10 years old, but are rather big for our age; being one of the largest of the 108 du Pont plant and office locations. We have had a major construction organization on our plant site since first work began in 1945, and are still looking forward to sizable plant additions.

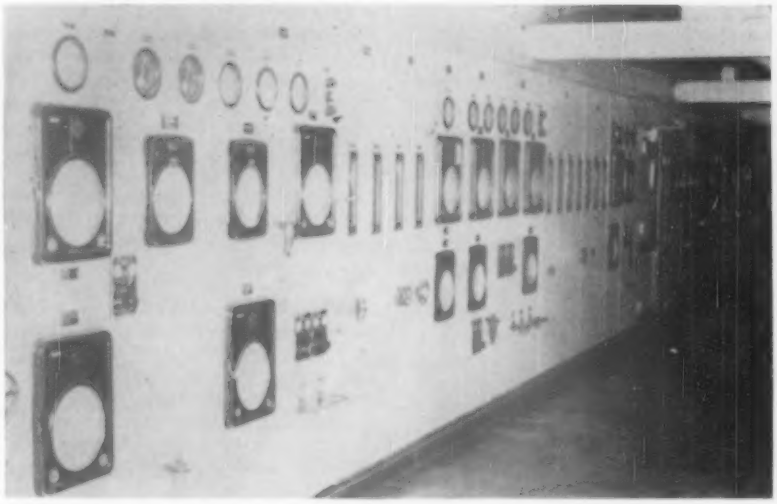
Our operating force totals a little under 1,800, and the mechanical organization comprises 47 per cent of this. The number of people doing maintenance exceeds the number assigned to the production function by 23 per cent. This rather unusual relationship, in major part, results from the influences of mechanization and automation already mentioned.

Products . . . Our products of manufacture are relatively few in number, but are produced in huge quantities. Methanol is made by a high-pressure catalytic synthesis process from natural gas. Du Pont's polyethylene, Alathon polyethylene resin, is produced from ethylene, again by high-pressure synthesis. Ethylene is provided partly by outside purchase and the remainder by thermal cracking of propane in Lummus-design furnaces.

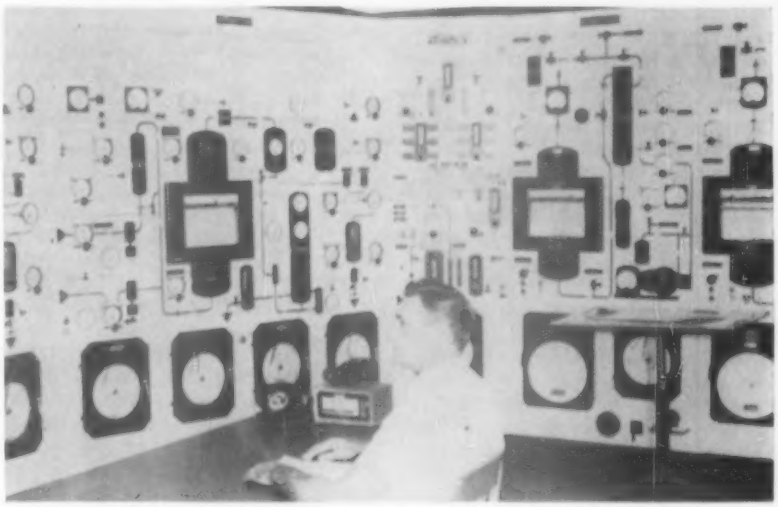
We are probably best known as a nylon plant, that being our first basic product. However, we now produce only the chemical intermediates for nylon; namely, adipic acid and hexamethylene diamine. Ingredient materials in these cases are adiponitrile obtained from our Victoria, Tex., plant; benzene and cyclohexane procured from various coke and petrochemicals plants; and nitric acid. The highly refined nylon intermediates are shipped by rail to various nylon-yarn plants of the du Pont company which are located in eastern states.

Technical Strength for Maintenance

Let's turn again to the main theme of this discussion, maintenance progress. In a rapidly advancing technological environment, we have recognized the need for a technically strong maintenance organization, and have moved to incorporate this strength into all elements of our work. Not only have we relied upon formally trained engineers, but have striven to train our mechanics and foremen to recognize and cope with many of the technical aspects of their day-to-day work. Formal classroom sessions are a part of the regular training program. As we see it, the need for further training will not cease, and we have geared ourselves accordingly. Training and work assignment of the individual worker are on a broad and varied basis since we believe the versatile and widely experienced mechanic is worth much more



Control room, vintage 1945. With the war's end, the . . .



Impact of miniaturization was felt, as in this 1950 scene.

The next expected step in control rooms is the console unit

to the company, and to himself, through increased job security.

Organization . . . Throughout the supervisory organization is maintained a good balance of technical and administrative ability. In addition to the "in-line" supervisory personnel, most of whom have technical background, are staff engineers assigned to each major maintenance function. Fig. 1 demonstrates the point. Note that in each class of maintenance activity—mechanical, instrument and electrical—there is a complete administrative and engineering organization in its own right. These groups are further supplemented by a project and standard engineering organization which supplies the additional technical services listed.

How Costs Are Controlled

We have found that to combine an engineering approach with a sound cost-goal program is quite rewarding in terms of cost reduction. However, the cost goals must be factually and reasonably established to be effective.

Costs . . . The figures used in such a system must be reliable and accurate. Towards this objective, we use what we call a "job order-account system," combined with machine tabulating and equipment record cards. Items against which costs are accumulated are specified only after detailed analysis in the field, the prime objective being to meet the needs of area production and maintenance people. For example, the foreman is interested in the cost of maintaining the equipment under his responsibility, both as to type of machine or type of maintenance, as well as his over-all costs. The next level of supervision wants a summation of the expenditures by his several foremen, and so on. Through streamlined job-order and machine-accounting techniques, such individualized information is produced promptly by tabulating equipment in a form readily usable in the field.

With such information readily available, and with a good equipment record-card system, realistic cost goals can be established, high-cost-equipment elements can be easily spotlighted, and areas of unusual expenditure can be discovered, thus allowing proper assignment of engineering effort towards both problem solution and the concomitant cost reduction.

Cost goals . . . As the cost-reduction system is practiced at Sabine, cost goals in terms of material and manpower are established against each cost account at the beginning of each year, subject to quarterly review in line with changing production forecasts. Of great significance is the fact that these goals are self-imposed; i.e., those individuals responsible for expenditures against the accounts will set their own goals.

It is understood that goals, as we use the term are not budgets within which to work. Rather, goals are to be set at a level to constitute a real challenge to the group's ability to meet it, due allowance being made for improved productivity. Once established, however, official accountability is based upon these goals.

Cost meetings . . . General review of performance against goals is made quarterly on a formal basis by both production and maintenance (the plant manager and other management personnel in attendance); and every effort is made to achieve a favorable cost trend by all those involved. Our cost meetings are so popular that we often use our large auditorium to accommodate the crowd! In many instances our foremen present divisional cost trends in these cost meetings. Foremen also maintain cost-performance charts covering their own assigned areas, which are reviewed with their workmen on a periodic basis.

Many cost-reduction ideas involving both labor and material generate with the mechanic in the field; and these ideas are usually unstintingly given, because it is known that job security nowadays depends largely upon ability to produce efficiently and to remain competitive.

Such "public" cost reviewing spotlights to everyone the high-cost elements of the plant's activity. Interest towards bringing the problems under control is generated in every division; each group thus becomes more readily sympathetic and willing to help the efforts of the other to achieve the cost reduction. It becomes easy to see where first effort should be applied when the dollar value is applied to each problem.

As a result of this spotlighting, programs for elimination or control of the costly items are established. A most important feature is the assignment to engineers of the specific tasks to be accomplished, of course with dollar values and target dates included. Problem task forces are often assigned when several groups are involved, or where the item is of unusual significance. Not only are technical personnel called upon in instances like these, but production and maintenance people participate actively when the matter is appropriate to their area of interest.

The Nature of Our Maintenance

Now let us turn away from the administrative phases of our maintenance to take a look at several of the elements of repair activity in which we are regularly engaged.

In our work we have established three general divisions of maintenance activity—mechanical, instrument, and electrical. Mechanical maintenance accounts for 78 per cent of the total, instrument 15 per cent, and electrical 7 per cent.

TABLE 1—MECHANICAL MAINTENANCE

(78 per cent of total maintenance)

	Per cent of mechanical maintenance
Process pipinig (excluding insulation)	28.0
Compressors (compression end only)	11.1
Prime movers	5.5
Refining trains	10.0
Pumps—reciprocating	3.1
Pumps—centrifugal	4.1
Insulation	2.6
Painting	4.0
Buildings—general facilities—grounds	5.1
Service headers	2.7
Shops and tools	4.7
Transportation	2.6
Air conditioning	1.5
Design changes and revisions	9.5
Miscellaneous	5.5

The percentages are based on relative cost, using 1955 experience, and include both material and labor expenditures. At this point a mention of material and labor ratios may be of interest. Over the past 2 years, material accounted for about 37 per cent of the total repair bill, and labor 63 per cent, exclusive of overhead. Table 1 gives a list of mechanical-maintenance items.

Mechanical Maintenance

As shown in Table 1, process piping, refining trains, and compressors with their prime movers constitute major elements. Note that these items, in sum, are greater than all other mechanical elements combined.

A discussion of the principal ones may be of interest.

1. Process Piping

An unusually wide range of piping specifications exists in our operation. Pressures range from vacuum to 30,000 psi., temperatures from —40° to 1,100° C., process materials from strong acid and strong caustic to water, various hydrocarbons, clear liquids, and concentrated slurries.

To meet such conditions, many types of metals and alloys are necessary. Bimetallics and plastics are also common.

Proper welding and fabrication are of course extremely important in such a situation and we try to stay abreast of the most modern techniques. Keeping welding mechanics qualified for superpressure work requires painstaking care and practice. There is more maintenance money spent in keeping men qualified for high-pressure welding than in doing the actual repair weld-

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Above—Untreated fuel oil, after aging, (magnified 200X) showing typical sludge formation.

Below—Nalco treated . . . same fuel oil . . . same aging, showing sludge prevention.

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- PREVENT SLUDGE FORMATION
- INHIBIT RUST AND CORROSION

and

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Nalco treatments give you all these benefits at low chemical dosage . . . and at low chemical cost.

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Sludge deposits in tanks of residual fuel and crude oil can be cleaned up quickly and conveniently with powerful dispersion type treatments offered by Nalco. Labor costs are eliminated, maximum storage capacity is restored, and *sludge is converted to usable oil.*

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ing itself. However, we know this preventive approach pays off because welding failures in our operation have been reduced to a very low level.

Corrosion of steel piping and equipment by hot brackish water is one of our major problems. Ten mils per annum is considered an acceptable maximum rate of corrosion for readily accessible piping. A much lower rate is sought after for more expensive, specialized equipment. Cooler life has been extended by metalizing the external surfaces of the coils with aluminum sprayed on as the final coating. Several plastic coatings, such as phenolic and epoxylene resins, are currently being investigated as replacements for the present metalized finishes. Cathodic protection of coils via water submersion has been found to be quite helpful.

Piping vibration sometimes becomes a problem where high-pressure and high-capacity equipment are involved, particularly where several units, which are sources of vibration, are concentrated in a limited area. Attention must be given to such situations for reasons of safety as well as the threat to continuity of operation. Fatigue failures can occur readily where extreme vibration exists. Also control instruments are seriously handicapped when operating under these conditions. Desirable, though sometimes very expensive, correction can often be accomplished through the use of pulsation dampeners. When this is impractical, we have used methods such as additional bracing, more rugged supports, and isolation from the source of vibration.

Where piping is used in **high-temperature** environment, special problems can be expected. We use propane-cracking furnaces in the manufacture of ethylene. During the cracking operation, at high temperatures, coke is formed in the reactor coil. The coke causes several separate and distinct types of coil failure, the main one being due to carburization. Carburization embrittles and thereby weakens the tubes until they crack under the thermal stress of operation. The coke deposit on the inside of the tubes gradually diffuses into the metal. Rate of carburization is dependent on tube-wall temperatures, which are increased by the insulating effect of coke deposits.

An important method in reducing the failures has been the reduction of impurities in the feed; namely, propylene. Careful welding techniques, replacement of complete coils when failure frequency warrants, and calorizing of the tubes, have all helped to bring this problem under control.

Another tube-failure situation exists in our natural-gas reformers. The tubes here are vertically supported, 8-in. 310 stainless-steel tubes which contain a solid catalyst and through which natural gas is passed under high-temperature conditions. Severe oxidation occurs on the tube surface in the hottest part, or lower section of the furnace where the temperature range is from 870° to 1,000° C.

We have learned to keep seam welds on tubes turned away from the hotter furnace-wall surfaces, that burner blocks should be maintained in good condition, and that excess air through the furnace should be kept under close control.

The lower section of a tube is the place where severest oxidation usually occurs. For failure here, a 10-ft. section is usually welded in to replace the damaged area. Where local oxidation appears in the form of pits, a scab patch is usually applied.

2. Refining Trains

The wide variety of process materials and process conditions encountered naturally leads to a wide variety of maintenance problems with distillation units. In most cases, materials of construction and equipment design offer optimum resistance to process chemical attack; however, we sometimes encounter localized trouble, such as that with bubble caps or their retaining bolts and nuts. At times it is necessary to tack weld the bubble caps in place to reduce failure frequency.

Process plugging, inadequate tray support, and access to the equipment are often encountered as problems on still columns. Process plugging can get to be quite disconcerting. The wide variety of process gums and tars, scales, and scums that settle in columns, condensers, and calandrias represents a constant challenge and requires that considerable emphasis be placed on **adequate tools and facilities for cleaning work.** Though most of our tube bundle cleaning is done at the plant, use is made of outside facilities where unusually severe cleaning situations are met.

In a number of instances we have encountered severe situations on the water side of refining-train equipment. For example, use of a specific stainless steel for condenser tubing may eliminate process attack, but failures can and do occur owing to stress corrosion originating from chlorides in the cooling water. As a result, we have devoted major attentin to tube sheet-venting design, water-baffle locations, and cooling-water temperatures to minimize such attack.

The seriousness of chloride content can be illustrated by two specific examples. For 5 years, operation of a particular calandria provided with stainless-steel tubes had not produced tube deterioration. Suddenly four sets of tubes failed completely within a 2-month period due to stress corrosion. Entrance of chlorides into the process system was traced to a service water hose which had been directed on a pump seal to prevent gassing. Removal of the hose corrected the situation. In a second instance, service water applied to the outside of a stainless distillation column to wash down a very small process leak resulted in extensive stress-corrosion failure of the column sections.

3. Compressors

Approximately 90 major compressors are used to carry 80,000 hp. of compression load. **Over one-half of this effort is at 5,000 psi. pressure or above.** Thus it is readily apparent why 11 per cent of mechanical maintenance is expended in keeping these machines running. Our largest is a high-speed centrifugal running at 8,200 r.p.m. and carrying 3,500 hp. By far the greatest portion of the compressors in the plant are reciprocating machines. One installation of 20 unit totals 32,000 hp., compressing gas to a pressure level of approximately 5,000 psi.

Principal difficulties occur with valves, cylinders, piston rods, and packing retainers.

We use a pressure indicator to spot bad valves. By taking indicator cards we determine, on a double-acting piston, whether the bad valve is on the hand end or crank end of the cylinder and whether it is the suction or discharge valve that is broken or partially plugged. We have found that this is a much more effective way of detecting partially plugged valves than the use of a skin pyrometer which will only indicate hot valves.

We have successfully repaired cracked cylinders by metal-locking along the cracks and remachining.

Piston-rod endurance life has been lengthened by surface-hardening the areas on which the packing rides. Fatigue failures of piston rods have been reduced by distributing stresses by using a tapered shaft nut, undercutting or using rolled threads, or nitriding the threads and packing surfaces. Change of material of construction also has been used in several instances.

Fatigue failures of packing retainers are experienced in high-pressure service. This problem has been brought under control by redesign of the retainers to reduce stress raisers. One major stress point was removed by eliminating tie-rod holes formerly used.

4. Prime Movers

At our plant there are three basic types of prime movers or driving units

—natural-gas engines, steam engines and steam turbines, and electric motors.

The combined rating of our major prime movers exceeds 115,000 hp. excluding motor drives less than 150 hp.

Internal-combustion engines using natural gas are used in a wide variety of applications. Engines in this service vary in size from 1,600 to 150 hp. and we use both two and four cycle.

The **selection of steam prime movers** is governed to a great degree by the plant heat-balance requirements. Steam is generated at 550 psig. which is the throttle pressure for the majority of the steam machines. Turbines account for over 26,000 hp., and reciprocating steam-driven equipment 12,000 hp.

Electric motors also play an important role. We have the conventional sizes for driving chemical pumps and the like, as well as many large motors for water pumping, gas compression, and extrusion applications. Size runs from fractional to as great as 3,500 hp. The approximate number of motors is 2,500.

Over-all availability of our driving units exceed 98 per cent. Overhauls are of a preventive-maintenance type and are performed on a scheduled basis. They are forecast from a knowledge of the equipment service, design and familiarity with potential sources of failure, and occur on a frequency of 12 to 36 months.

Maintenance work is performed so as to minimize the effect on production capability. However, an aggressive maintenance philosophy is followed, as demonstrated by the fact that we sometimes insist that overhaul work be done despite production demands. Emphasis is toward extended periods between overhauls, consistent with a realistic knowledge of the equipment and the necessity to maintain high standards of maintenance.

5. Mechanical Seals

Leakage in process pumps in a chemical plant should be held to a minimum. Therefore, many of our centrifugal pumps are equipped with mechanical seals. While performance of all pumps is regularly studied, major emphasis is placed on those which are most troublesome from a labor and material-cost viewpoint.

Seal design varies in accordance with pump design and process conditions. We use nine different types of seals. One of these is somewhat unique in that it utilizes a Teflon tetrafluoroethylene resin bellows to exert pressure against the seal faces instead of the conventional spring.

Pressures, temperatures, process material, size and speed of the shaft, and design of the equipment are all important factors to be considered in the selection of a proper seal design and material.

Among seal materials that have given good life are Graphitar 14 or 39, running against ceramic, and glass-filled Teflon tetrafluoroethylene resin, running against ceramic. In both installations a constant-volume water flush is used.

In 1955 average life of all mechanical seals in our acid area was 37 weeks. Life of seals in nitric acid service was 23 weeks, and the average life of seals in nonacid service was 89 weeks. Presently, we are making about one seal change for every 15 pumps per month.

Progress made in mechanical-seal performance is the result of comprehensive training of mechanics and operators in the proper techniques of seal installation and operations, continual experimentation with new materials, and close engineering followup.

6. Application of Plastics

We consider plastics an important addition to the family of maintenance materials. Many tough problems have been solved through their use. Plastics have excellent chemical resistivity, are light in weight, and are generally easy to fabricate, install, and maintain. Minimum lubrication is required for mechanical application. They make ex-

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cellent electrical insulation. However, there are several limitations to plastics which must be recognized, such as flammability, high temperatures, relatively low strength, and high creep rate.

Among the list of successful applications at our plant are pipe, drip-cooler protection, instrument tubing, bushings and bearings, piston rings, flexible hose, filter cloths, and many others.

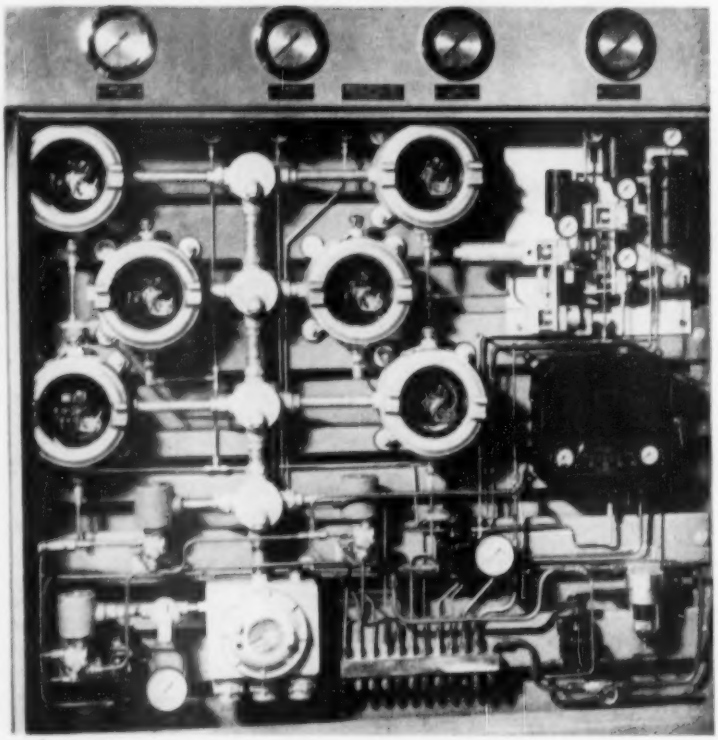
Instrument Maintenance

A major element in petrochemicals maintenance is instrumentation, and it is growing by leaps and bounds. With over 25,000 units of control equipment, and this number includes only automatic valves, gages, recorders, and controllers, a good preventive maintenance system is a must, and reference to Table 2 will show its magnitude, as we practice it.

TABLE 2—INSTRUMENT MAINTENANCE
(15 per cent of total maintenance)

	Per cent of instrument maintenance
Preventive maintenance	56.3
General process repairs	15.1
Design changes and revisions	14.0
Shops and tools	6.4
Miscellaneous	8.2

PROTECTION
for
GAS TURBINES



MERCOID SAFETY CONTROL PANELS

Illustration above is a typical custom made explosion proof Mercoid Safety Control Panel which safeguards gas turbines by providing the following control functions: Clutch pressure • High Pressure lube oil • Axial Compressor discharge • Bearing lube oil pressure • Fuel supply pressure • Overspeed pressure • Impeller pressure • Starting turbine throttle pressure • Lube oil high temperature • Exhaust temperature shutdown • Exhaust Temperature alarm. There are many more safety functions Mercoid can provide—our engineers will be pleased to offer their recommendations on the proper application of Mercoid Safety Controls for your gas turbines.

Write for details

THE MERCOID CORPORATION

4201 Belmont Ave., Chicago 41, Ill.

Preventive maintenance . . . To evaluate the benefits of preventive maintenance we recently conducted a statistical analysis study, in which the probability of shutdown of a large and highly important process unit was considered. The unit is highly instrumented and interlocked with a great many electronic and other components. The number of shutdowns that would likely occur was calculated, based upon normal expectancy of failure of the individual components, and if no preventive maintenance were performed to keep the units in good condition. Compared with this was the actual shutdown experience with the preventive-maintenance program in effect. The contrast was remarkable. Without PM we would probably experience 26 shutdowns per month; whereas actual shutdowns, attributable to the components being studied, were less than one per month!

Through use of I.B.M. tabulating equipment, a comprehensive system of checking, correcting and recording all essential control components and data has been achieved. In addition to providing equipment-record-card data for the instrument man in the field, these records are used for engineering evaluation.

Revisions . . . Fourteen per cent of the instrument maintenance dollar is spent on making design changes, revisions, and modernization. This is exclusive of the many capital expenditures for these purposes which represent increase in plant investment. As an example we propose to install data-reduction equipment which will allow consolidation of two control rooms into one, as well as allow abandonment of certain obsolete, high-maintenance type of control units.

In this fast-moving field, training to follow advances in the art is essential. Formal classroom courses are given to both the mechanic and the engineer. Such training includes refresher courses in mathematics, physics, thermodynamics, and the like, as well as detailed instruction specific to the many new techniques being applied in modern plant instrumentation.

Electrical Maintenance

A survey of the electrical cost distribution is shown in Table 3.

We have found it prudent to spend maintenance dollars on organized rather than emergency repair of electrical equipment. This is particularly true since our processes are basically continuous rather than batch, and a few hours down time can easily represent thousands of dollars loss.

To help achieve adequate availability we concentrate on the prevention

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of electrical interruptions from causes such as insulation breakdowns, faulty or inadequate relaying, overloaded circuits and transformers, lightning surges, bearing failures, etc. Whenever possible, only proven components are selected in original installations. In some cases, additional reliability is achieved through detailed reinspection of new equipment. Insulation levels are periodically checked and corrected. Our motors are given special insulation treatment to prolong life between rewinds. Current motor-failure experience runs at between 1 and 1½ per cent per year, which we consider good considering high-humidity conditions.

Special attention is given to fire and explosion hazards. Proper hazard classification of electrical equipment versus operating environment is maintained and reviewed periodically.

Our electrical work is closely allied with instrumentation. The instrumentation and electrical mechanic, as well as the instrument and electrical engineer, closely coordinate their activities, maintenance efforts, and developments.

The changes and revisions in electrical work represent, as in the instrument field, a relatively large portion of electrical cost, and are due to the same influence.

TABLE 3—ELECTRICAL MAINTENANCE
(7 per cent of total maintenance)

	Per cent of electrical maintenance
Preventive maintenance	14.0
Motors	13.1
General process repairs	24.2
Design changes and revisions	15.0
Shops and tools	8.5
Relamping	6.0
Communications	2.1
Miscellaneous	17.1

The Accomplishment

We have looked at the general trends in petrochemicals maintenance, have outlined the organized program by which our plant is facing the challenges represented in these trends, and have reviewed the nature of some of the specific problems experienced at this plant.

The questions may well be asked—"What has been accomplished? Can you be certain that the things being done are producing the desired results?"

The answer? We know that much has been accomplished, based on measurement in terms of factors that are meaningful and easy to understand.

The production level at the end of 1955 was the highest in the history of the plant, with the average for the year 25 per cent above that in 1954. Plant size increased by approximately 13 per cent in this 2-year period. In the face of the increased maintenance burden which has resulted, over-all maintenance costs have been markedly reduced, even in the face of materially higher wage rates, material prices and employe benefits.

Ratio of maintenance costs to plant investment (replacement basis) has dropped from 5.9 in 1953 to 5.0 in 1954 and 4.3 in 1955. The number of personnel required in the maintenance function has been reduced by 126 people in this period. Capital tied up in spare parts and extra machinery has been cut by one-third.

No sacrifice has been made in upkeep or maintenance standards. To the contrary, many improvements have been accomplished. And I've left one of the most gratifying statistics to the last. At the time of this writing only one major injury has occurred to anyone in the mechanical group since November 1952, and this injury was not of serious consequence.

We recognize the need to continue to make such improvements in these days of stiff competition, heavy production demands, and advanced mechanization. The cost consciousness that now exists in our organization, plus continued and even greater application of engineered maintenance will undoubtedly help us attain this obpective.

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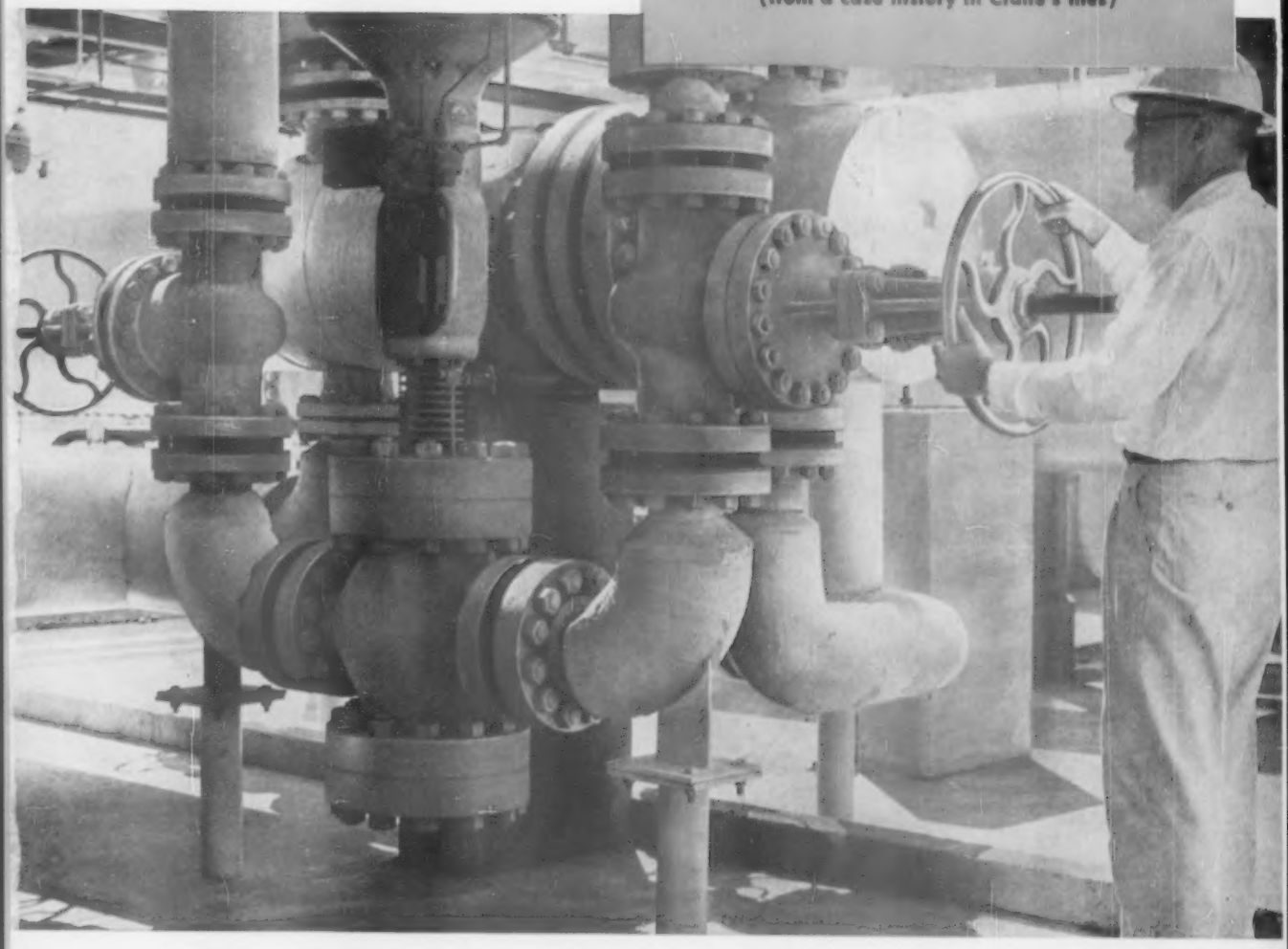
CLUTCHES

INTERESTING FACTS ON VALVE PERFORMANCE

(from a case history in Crane's files)



These valves tight and trouble-free after 3 years on severe reboiler service

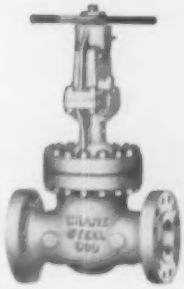
Here's the kind of valve performance every refinery would like to be getting.

When Delhi-Taylor Oil Corp. built a catalytic reforming unit in their Texas refinery in 1953, they installed these Crane 8-inch, No. 83X 900-pound steel valves on the lines to the reboiler. The valves—a wedge gate type—handle process fluids mixed with hydrogen gas at 550 psi. and 900° F.

What's the story on these Crane valves after 3 years on this extra-severe service? No maintenance of any kind—and they're closing just as tight and sure as the day they were put in the lines.

Outstanding performance? Yes, but not unusual for Crane valves. You'll find them with cost-free service records in practically any refinery you visit . . . because Crane valves and fittings are strictly quality-made, which means you get strictly quality performance.

Call your local Crane Representative for valuable help in specifying and ordering valves and fittings for any piping service. Or, write to address below.



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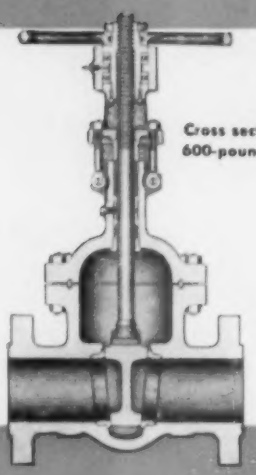
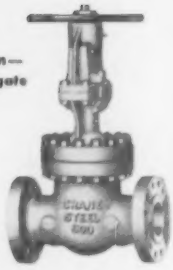
Crane Steel Wedge Gate Valves

Screwed, flanged or butt-welding ends • Sizes up to 24 inches • In 150, 300, 400, 600, 900, 1500 and 2500-pound pressure classes

Although compact, these gate valves still have extra heft where it counts. Note in this cross section of a 600-pound gate the fully guided disc to minimize wear . . . the non-rigid T-head disc-stem connection . . . the deep, more effective stuffing box . . . clean, straight-through flow design.

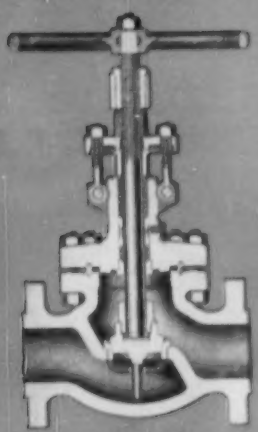


Cross section—600-pound gate



900-pound gate—flanged

Crane Steel Globe and Angle Valves



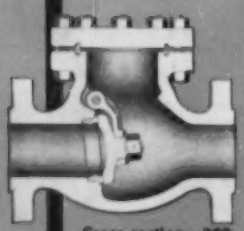
Cross section—600-pound globe

With plug-type or ball-type disc • Screwed, flanged or welded ends • Sizes up to 8 inches • 150, 300, 400, 600, 900, 1500 and 2500-pound pressure classes

A glance at this cross section of a Crane 600-pound globe valve gives you the inside story. Look at the deep bearing surfaces the plug-type disc and seat give you. Note the heavy stem and yoke; the bonnet bushing providing accurate stem guidance. Other features are a free-swivel, disc-stem connection and the large-area stuffing box.

300-pound angle—flanged

Crane Steel Check Valves



Cross section—300-pound swing check

600-pound swing check—flanged

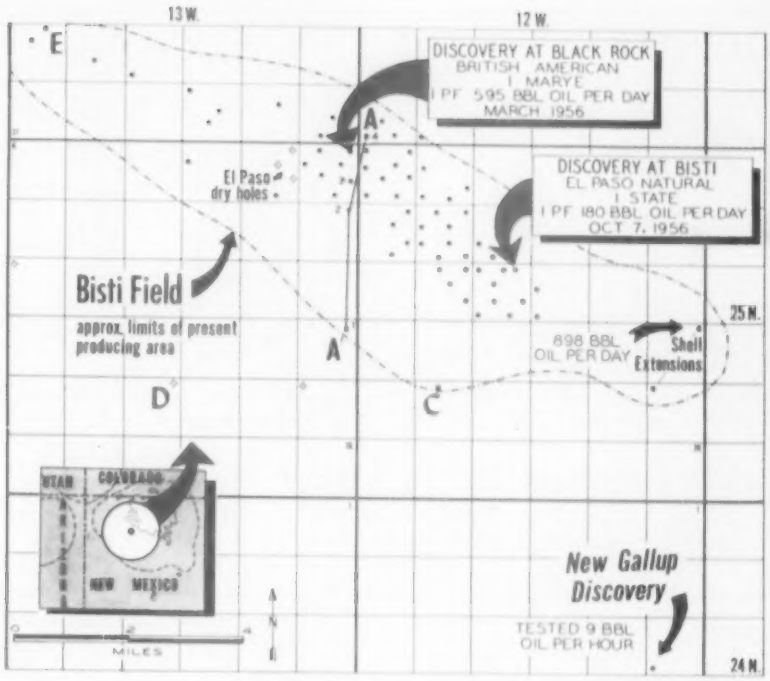
Swing type • Screwed, flanged or welded ends • Sizes to 12 inches • In 150, 300, 400, 600, 900, 1500 and 2500-pound pressure classes

Full port area is maintained from inlet to valve seat for turbulence-free design to minimize erosion and flow resistance. The correctly proportioned body allows full swing of the disc. Cross section of 300-pound Crane swing check valve shown.

America's Favorite Guidebook to Proper Valve Selection

You'll find quick help to all your valve selection problems in your handy Crane catalog. It's arranged for easy reference . . . written to supply clear, complete details on exactly the valves you require. Use it often—you can profit by it every time.

A RAPID exploratory drilling program at Bisti has outlined a large strat trat in the Lower Gallup at a depth of about 5,000 ft. Fig. 1.



Strat oil, easy drilling, and large proved acreage are some reasons why . . .

Bisti Is a New Bright Hope

by Norman S. Morrisey
Drilling-Development Editor

STRAT traps are big. Look at Pembina . . . 400,000 acres. Look at East Texas . . . 135,000 acres. Look at West Edmond in Oklahoma . . . 30,000 acres.

But Rocky Mountain oil finders are not spending their time studying these strat traps. They are taking a close look at Bisti* in the San Juan basin of northwestern New Mexico (Fig. 1).

Of course this new field is not as big as any of the three mentioned above. But . . . Bisti has proved conclusively that Cretaceous oil can and does occur in commercial quantities in northwestern New Mexico. Already some 25,000 acres are considered proved or semiproved. Operators are "guestimating" recoverable reserves in terms of 25 to 40 million barrels by primary methods.

Stratigraphic oil in the lower Gallup sand at a drilling depth of 5,000 ft. has completely altered the exploration thinking in the San Juan basin. Geologists long thought that the Cretaceous sands in the San Juan basin were primarily gas zones. Prior to the discovery of Bisti and Black Rock, developments tended to support this conclusion. Of course there were minor amounts of Cretaceous oil produced on several of the anticlines in the basin. But by and large, the San Juan basin was a gas area.

Oil production at Bisti is anomalous. The oil occurs in the lower Gallup section from a sand zone that is approximately 150 ft. thick. Downdip to the northeast, gas is produced from the same stratigraphic interval that produces oil at Bisti. Updip to the southwest, the same section is present on the outcrop.

What has trapped the oil? Best evidence to date indicates that a permeability barrier prevented the oil from migrating updip. Probably the downdip gas area is separated from the oil reservoir by an impermeable section in the lower Gallup (Fig. 2).

Producing section . . . Geologists divide the lower Gallup (Fig. 2) into three producing zones: the upper, middle, and lower. The upper zone is by far the best reservoir and in many wells will flow without fracture treatment. The middle zone rates next as an oil reservoir, and the lower zone is considered to be the poorest of the three zones.

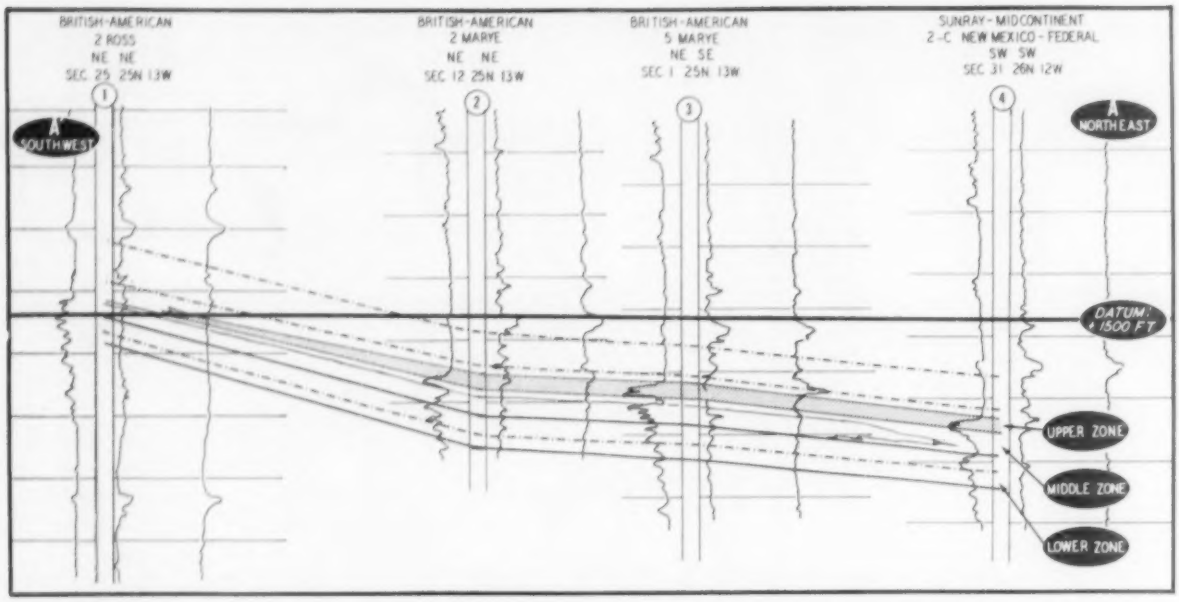
The upper zone varies in thickness from 0 to 25 ft., with an average net pay thickness of 16 ft. Porosities in this part of the section average about 16 per cent. Usually this zone is the only one of the three to show measurable permeabilities. The upper zone has flowed at the rate of 35 bbl. of oil per hour natural, and normally will not require fracture treatment.

In some of the better wells, the middle zone will flow natural, but the customary practice is to fracture the zone through perforations. In the British American Oil Producing Co. 5 Marye, the middle zone flowed 233 bbl. of oil in 7 hours natural.

On the electric log, the appearance of the middle zone is quite deceiving. The chances are excellent that it would be ignored as a potential pay zone in wildcat territory. Cores taken in the

*This field was originally called Bisti-Black Rock, but since the two fields have been linked is now designated Bisti.

EXPLORATION



CROSS-SECTION A-A' shows the erratic nature of the producing zones at Bisti. Notice that the upper zone apparently shales out updip and the middle zone shales out downdip. Fig. 2.

TABLE 1—TIME ANALYSIS
(From spud date to rig release)

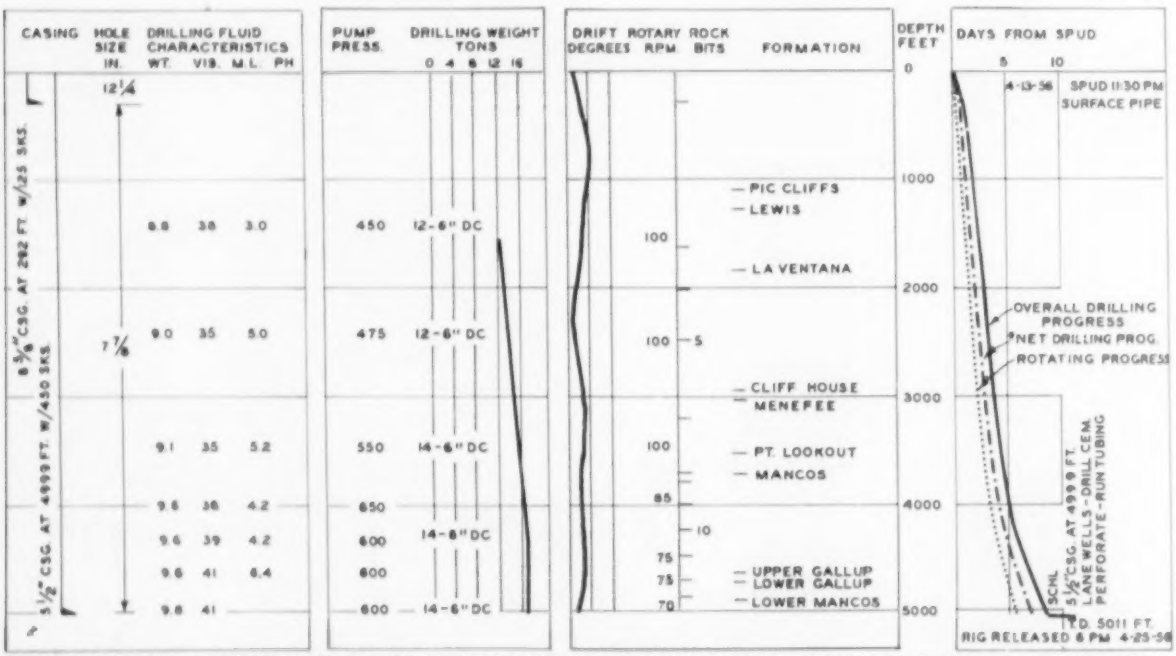
	Days	Per cent
On bottom, normal trips, rig service, etc.	7.1	60.7
Mechanical downtime	0.2	1.7
Hole condition, mix mud	0.2	1.7
Surveys—Schlumberger, Lane-Wells	0.9	7.7
Casing—reaming, running, W.O.C.	2.4	20.5
Completion	0.9	7.7
Total	11.7	100.0

TABLE 2—BIT SUMMARY

	Hole size 12¼-in.	Hole size 7⅞-in.
Number bits	1	12
Footage	298	4,713
Number hours	8.5	122
Feet per hour	35	38.6
Feet per bit	298	392
Hours on bottom per bit	8.5	10.2

TABLE 3—MUD ADDITIVES
(Tabulated from drilling reports)

Bentonite, lb.	6,300
Tannin, lb.	702
Sodium bicarbonate, lb.	400
Driscose, lb.	250
Phosphate, lb.	200
Oil emulsifier, gal.	133
Oil, bbl.	84
Lime, lb.	50



* INCLUDES ONLY TIME ON BOTTOM, NORMAL TRIPS, CONNECTIONS, DRIFT SURVEYS, RIG SERVICE—RELATED TO NORMAL DRILLING PROGRESS

TYPICAL DRILLING CURVE for a well at Bisti. This well was completed in 11.7 days. Fig. 3.

zone show a fair sand development, and analysis of these cores reveals a tight but porous sand.

Reservoir characteristics deteriorate vertically in the Gallup, making the lower zone the least attractive oil pay of the three zones. It, too, like the middle zone, must be fractured and seldom it ever will yield any appreciable amounts of fluid prior to fracturing. After treatment, the lower zone will flow 10-20 bb. of oil per hour. In the British American 5 Marye, the lower zone tested 1½ bbl. of oil per hour natural. After treatment, the zone flowed 322 bbl. of load oil and 340 bbl. of new oil in 20 hours.

Reserves . . . Although it is too early to determine conclusively what type of drive the Bisti reservoir has, a safe guess is that it is a gas-in-solution type. Most strat traps fall in this category. Notoriously, ultimate primary recoveries from such reservoirs are low, usually on the order of 100-200 bbl. per acre-ft. of sand. Core data in the Bisti field indicate that primary recoveries should fall in the 2,500-3,000-bbl. per acre bracket.

Some engineers have likened the New Mexico field to Canada's great strat trap, Pembina. And the fields do have some striking similarities. Both the Cardium and the Gallup are divided into three pay zones. The Cardium is broken down into (1) an upper conglomerate zone, 0-35 ft. thick; (2) a middle pay zone or "upper sand," 0-35 ft. thick (this is termed the main pay sand); and (3) the lower sand, 5-20 ft. thick.

Estimates of primary recoveries from both the Cardium and the Gallup are comparable, running between 2,500 and 3,000 bbl. per acre. Both are pinchouts related to permeability barriers. Both are being developed on 80-acre spacing to insure a reasonable payout.

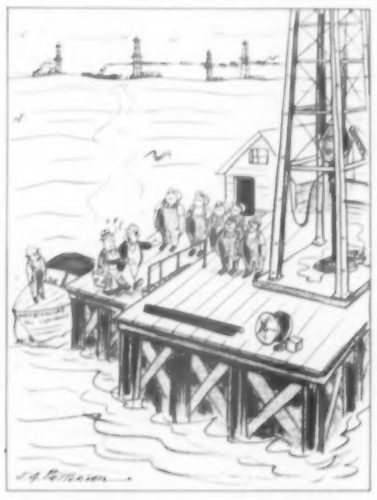
To date, Bisti is considerably smaller than Pembina, 25,000 acres contrasted with 400,000. At Pembina, the main pay sand averages 20 ft. thick; at Bisti the upper zone has an average thickness of 16 ft., and the total net pay section is 35 ft. thick.

Acreage costs alone make Bisti a more attractive venture than Pembina. The initial cost of acreage at Bisti was low. At Pembina, bidding for crown leases forced the price up to the point where oil companies were actually buying semiproved reserves.

Current price for Pembina crude is $2.52 per bbl., compared with Bisti's $2.76. Field wells at Pembina cost $80,000, exactly the same figure for a Bisti field well.

Drilling and completion program . . . Bisti offers few drilling problems (Fig. 3). The 5,109-ft. wells are drilled in 2 weeks or less. Customary practice is to drill through the entire pay section and set the oil string on bottom.

Most operators perforate and treat each zone separately. The upper zone will flow naturally and more often than not does not require fracture treatment. The middle and lower zones respond well to fracturing. Customary treatment is 25,000 gal. of oil and 25,000 lb. of sand.



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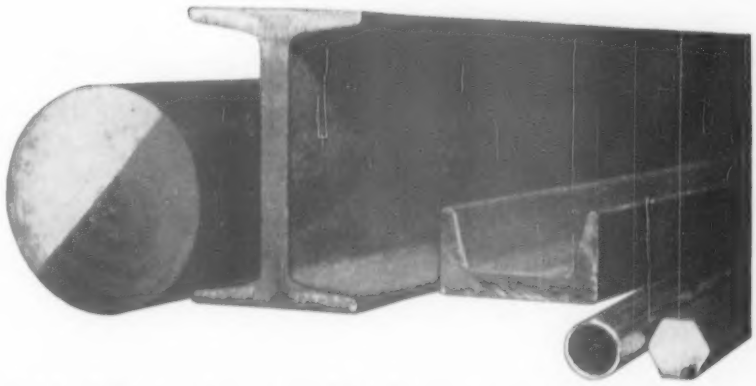

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How to Log Gas-Drilled Holes

In gas or air-drilled holes, lithology, probable productive zones for perforating, and productive intervals after perforating can be determined by a proper logging program. In the San Juan basin, logging tools which are doing this are the gamma ray, induction, and temperature logs.

by Robert E. Hiller

CONVENTIONAL electrical logs and MicroLogs cannot be used in holes drilled with gas. In the San Juan basin of New Mexico, gas drilling has been practiced for several years. Operators have settled upon a logging program designed to provide maximum information from the open hole. The three most common logging tools used are the gamma ray, induction log, and temperature log.

For the purpose of this article, the Point Lookout section of the Mesaverde formation will be considered. This Mesaverde formation makes little or no water during drilling, thus the holes, for logging purposes, are essentially dry.

The author is with Schlumberger Well Surveying Corp. He is a graduate of University of Colorado with a B.S. in electrical engineering. Since joining Schlumberger 5 years ago he has been working continuously in the San Juan basin. Article first appeared in the Rocky Mountain Oil Reporter.

Drilling Program

Wells are drilled into the Lewis shale by the usual rotary method, using mud. A conventional electric log is run to pick the casing point for the intermediate string. Casing is set and the mud displaced. Then gas drilling is begun and continued through the entire Mesaverde formation. At total depth, gamma ray, induction, and temperature logs are made. If the well should be making a large amount of gas natural, the operator may request the use of a lubricator for safety.

After these logs have been run, operators generally set and cement the production string on bottom. Gas production is obtained by selectively perforating in stages, beginning at the bottom. After each stage of perforating, a test or gage of the gas production can be made.

During the gas drilling, the returning gas is burned at a safe distance from the rig. This gas carries the drilled cuttings which can be trapped but are so fine that they are of little value to the geologist and engineer. Furthermore, since little coring is done, these men must rely on logs to study and evaluate the wells. They can obtain the information they need from the gamma ray, induction, and temperature logs.

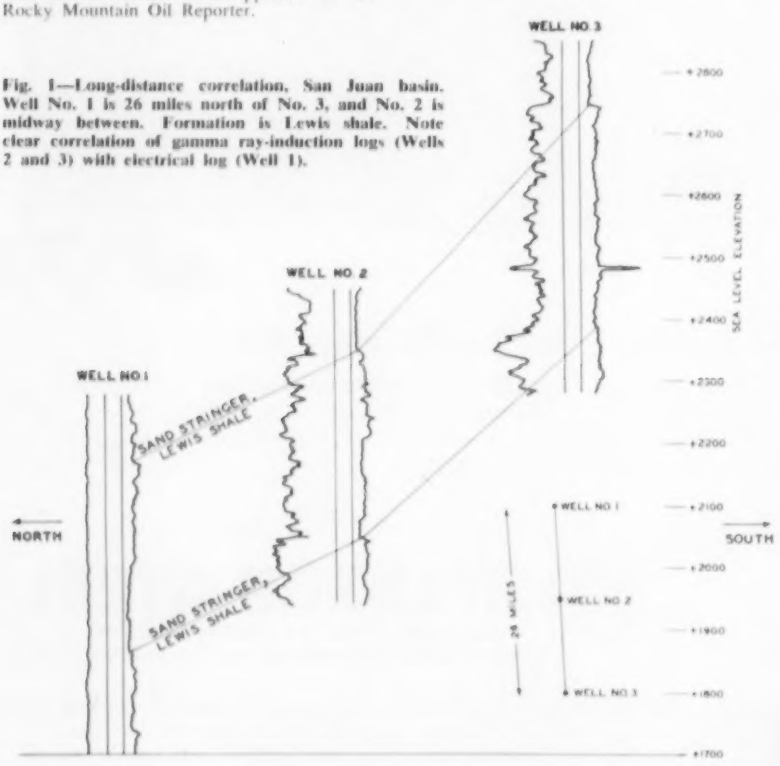

Fig. 1—Long-distance correlation, San Juan basin. Well No. 1 is 26 miles north of No. 3, and No. 2 is midway between. Formation is Lewis shale. Note clear correlation of gamma ray-induction logs (Wells 2 and 3) with electrical log (Well 1).

Gamma Log

The gamma-ray log records the radioactivity of the formations. It delineates the sands and shales and thus determines the lithology. Also it indicates the amount of shale within a sand. Furthermore, it is a means of correlating formations from well to well (see Fig. 1).

Induction Logs

The induction log measures the formation resistivity and it can be easily correlated with the resistivity curve of an electrical log (Fig. 1). The true formation resistivity is measured by the induction log since the formation is not contaminated by drilling mud. If the induction log reads above a "critical resistivity," the well will very likely make dry gas. If it reads below the critical resistivity, some water may be produced. For the Point Lookout, this critical value has been taken to be 40 ohm-meters. However, recent study indicates that in some areas, it can be as low as 20 ohm-meters. The induction log, therefore, is quite diagnostic of what the sands will produce.

Temperature Log

The temperature log detects zones where gas enters the bore hole. Gas entering the well from a formation decreases in pressure, expands, and cools. Thus, the temperature opposite this entry will be below normal. The log shows this decrease of temperature and pin points the zone of gas entry.

Information . . . These three logs provide the geologist and engineer with

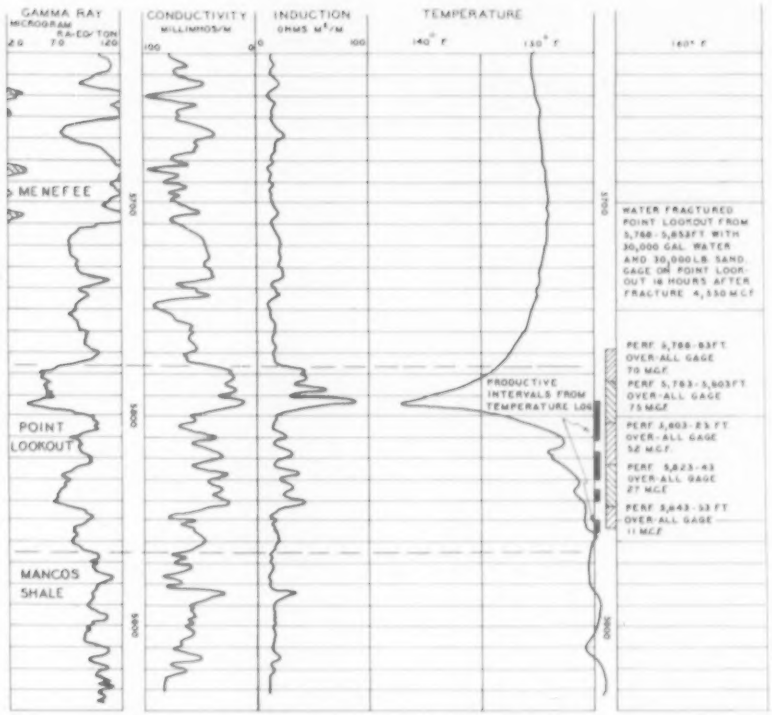

Fig. 2—Logs of Point Lookout formation, San Juan basin. Temperature log shows four zones of gas entry, the upper one being the largest. Five stages of perforating are indicated with over-all production gage (previous perforations included) for each stage.

most of the data they require for well evaluation and completion. The gamma ray for lithology and shale content of sands; the induction log for resistivity which is diagnostic of the fluid content of the sands; and the temperature log which locates gas entries. Figs. 2 and 3 are examples of these logs and how they are used.

Fig. 2 presents the logs over the Point Lookout formation in a well in the San Juan basin. This is a good well, making 70 M.c.f. natural and 4,550 M.c.f. after fracturing. The gamma-ray log shows several good sand bodies. The induction log in these sands reads from 30 to 90 ohm-meters. The temperature log shows one pronounced temperature decrease and three lesser ones, indicating four zones of gas entry.

After casing was set through the Point Lookout, it was perforated in five stages, beginning at the bottom. Production tests were made after each stage of perforating, the previously perforated sections being included. Perforated intervals and over-all production gages for each stage are shown on the figure.

The over-all gage showed a slight decrease after perforating the top interval (5,768 to 5,783 ft.), indicating that the well had blown down and that no additional gas was produced from this interval. Note that the temperature log shows no gas entry above 5,793 ft. Water fracturing increased the gas production enormously, 65 times in fact.

Fig. 3 shows the logs of the same formation in a well nearby that of Fig. 2. The gamma-ray log reveals that the sands are more shaly than those in the other well. The temperature log shows two slight temperature decreases indicating only two zones of gas entry and these of limited volume.[1] We would not expect this well to produce as much as the first well and this is borne out by the production test—only 39 M.c.f. natural and 1,150 M.c.f. after fracturing. Note that no additional gas was produced after perforating between and above the zones of gas entry marked on the temperature log. Water fracturing increased the production about 30 times.

In a dry drilled hole, the gamma ray, induction and temperature log combination provides adequate information as to lithology, fluid content, and gas entries. As a logging program in the San Juan basin, the trio has been highly successful.

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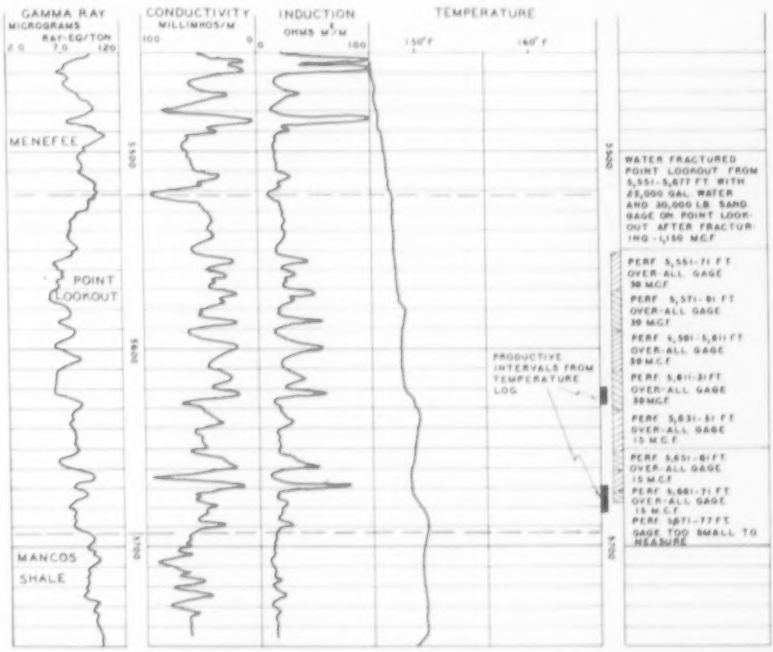
GAMMA RAY
MICROGRAMS RA-EQ/TON
CONDUCTIVITY
MILLIMHOS/M
INDUCTION
OHMS M²/M
TEMPERATURE
150° F
160° F
MENEFEE
POINT LOOKOUT
MANCOS SHALE
5700
5800
5900
6000
WATER FRACTURED POINT LOOKOUT FROM 5,551-5,677 FT WITH 25,000 GAL WATER AND 30,000 LB SAND. GAGE ON POINT LOOKOUT AFTER FRACTURING 1,150 M.C.F.
PERF 5,551-71 FT OVER-ALL GAGE 30 M.C.F.
PERF 5,571-81 FT OVER-ALL GAGE 30 M.C.F.
PERF 5,581-5,611 FT OVER-ALL GAGE 30 M.C.F.
PERF 5,611-31 FT OVER-ALL GAGE 30 M.C.F.
PERF 5,631-51 FT OVER-ALL GAGE 15 M.C.F.
PERF 5,651-61 FT OVER-ALL GAGE 15 M.C.F.
PERF 5,661-71 FT OVER-ALL GAGE 15 M.C.F.
PERF 5,671-77 FT GAGE TOO SMALL TO MEASURE
PRODUCTIVE INTERVALS FROM TEMPERATURE LOG

Fig. 3—Logs of same formation in a well near that of Fig. 2. Gamma ray indicates sands are more shaly. Temperature log shows fewer and smaller gas entries. Perforating stages and consequent production gages are indicated.

A New Series . . .

How to Interpret Electric Logs

THE OIL AND GAS JOURNAL takes much pleasure and pride in announcing the commencement of this series of nine articles on quantitative analyses of electric logs. The authors are distinguished scientists and engineers with a long record of experience and leadership in this field.

In the past most electrical logs were interpreted qualitatively by rules of thumb derived from extensive experience in a field. The rules often gave correct interpretations but years of experience were required to develop competence and it was virtually impossible for one to become expert in all areas.

Through the research work of many well-logging specialists a new quantitative log-analysis science has been developed and is now recognized as a specialized field. Evidence of the importance of the science is the fact that every major oil company maintains a log-analysis department and many of them carry on research work to improve the analytical methods. Competent consultants and independents serve the vast group of independent operators.

Also, analysis of logs of "dry holes" has opened up huge oil and gas reserves throughout the oil-producing world. Although the science is yet in the development stages, it is probably true that very few important oil or gas accumulations are missed today in wells that are properly logged.

Quantitative Loganalysis provides reservoir data on per cent porosity, per cent water saturation, thickness of pay sections, and estimates of permeability. An accurate analysis should make it possible for the operator to decide if the formation with "shows" will produce oil or water, and in the case of oil, will the recoverable reserves warrant spending vast sums for testing and

PRODUCING

Symbols and Definitions

AM = normal (two electrode) curve spacing.
AO = lateral (three electrode) curve spacing.
BHT = bottom-hole temperature, °F.
T° = mud temperature at formation, °F.
d = diameter of hole.
D_i = average diameter of invaded zone.
e = bed thickness.
t_{mc} = mud cake thickness.
R_m = resistivity of mud in ohm-meter at a given temperature.
R_{mf} = resistivity of mud filtrate at a given temperature, ohm-m.
R_{mc} = resistivity of mud cake at a given temperature, ohm-m.
R_w = resistivity of formation water at a given temperature, ohm-m.
R_{ws} = apparent resistivity of formation water in shaly sands, ohm-m.
R_x = resistivity of mixture of electrolytes, usually mud, mud filtrate and formation water, in invaded zone, ohm-m.
R_t = true resistivity of uncontaminated formation, ohm-m.
R_o = true resistivity of formation with 100 per cent water, ohm-m.
R_i = resistivity of invaded zone, ohm-m.
R_{xo} = resistivity of flushed zone, ohm-m.
R_s = resistivity of adjacent bed, usually shale, ohm-m.
$R_{.5}''$ = apparent resistivity of short normal, ohm-m.
$R_{1.0}''$ = apparent resistivity of intermediate normal, ohm-m.
$R_{4.0}''$ = apparent resistivity of long normal, ohm-m.
$R_{.5}'$ = apparent resistivity of short lateral, ohm-m.
$R_{1.0}'$ = apparent resistivity of lateral, ohm-m.
$R_{1''_{.5}}$, $R_{2''}$ = apparent resistivity of microsurvey curves, ohm-m.
F = formation resistivity factor. The ratio of the resistivity of the bed 100 per cent saturated with water to resistivity of the water.
F_a = apparent formation resistivity factor.
m = Archie's "cementation factor." Formation resistivity factor exponent.
Φ = porosity in per cent.
S_w = water saturation, per cent of pore space in uncontaminated zone.
S_i = water saturation in invaded zone.
S_{xo} = water saturation in flushed zone.
ROS = residual oil saturation as per cent of pore space ($1-S_{xo}$).
n = Archie's saturation exponent.
K = coefficient in the S.P. formula.
E_c = S.P. electrochemical component.
E_k = S.P. electrofiltration or streaming-potential component.
SSP = static spontaneous potential. The maximum possible S.P. for a given R_{mf}/R_w, mv.
PSP = pseudostatic spontaneous potential. The S.P. of a shaly sand, mv.
ASP = apparent S.P. of a bed, mv.
k = permeability, md.

Fundamental Equations

Archie's formula:

$$S_w^n = F \times R_w/R_t; \quad S_w = (R_o/R_t)^{1/n}$$

n may vary from 1.5 to 2.5, but is often close to 2.0.

Formation resistivity factor:

$$F = R_o/R_w \qquad F_a = R_{xo}/R_{mf}$$

Humble formula:

$$R = 0.62/\Phi^{2.15}$$

Archie formula:

$$F = 1/\Phi^m; \quad m = 1.3 \text{ to } 2.5$$

S.P. formulas:

$$SSP = -K \log_{10} R_{mf}/R_w \qquad PSP = -K \log_{10} R_{mf}/R_{ws}$$

DERIVED RELATIONSHIPS FOR Φ

Humble:	Archie:
$\Phi = (0.62/F)^{1/2.15}$	$\Phi = (1/F)^{1/m}$
$\Phi = (0.62 \times R_w/R_o)^{1/2.15}$	$\Phi = (R_w/R_o)^{1/m}$
$\Phi = [(0.62 \times R_{mf}/R_{xo})/(1-ROS)^2]^{1/2.15}$	$\Phi = [(R_{mf}/R_{xo})/(1-ROS)^2]^{1/m}$

There is a recent tendency to standardize n = 2.0 for all formations and to employ the Humble generalized formation-factor equation universally. However, many laboratory determinations indicate that n is not 2.0 for all formations and an equation of the Archie type containing a formation-resistivity-factor exponent, m, is sometimes more appropriate for a precise determination of S_w, water saturation, and Φ, per cent porosity. When these data are available they should be employed.

Chart 16 for S_w determination provides a variable n coefficient.

Chart 13 provides a conversion between the Humble and Archie relationships.

QUANTITATIVE LOG ANALYSIS—1

Fundamental Procedures And Nomenclature

by Dr. R. G. Hamilton and Paul Charrin

completing a well. Unfortunately today this is not always the case.

Enthusiasm for the new science, however, has created overconfidence in some. Misapplications of the techniques are possible. The equations employed contain variables related to the formations and their fluids. Major companies measure these in the laboratory to refine the equations. Unfortunately simplified or generalized relationships have been applied to all formations indiscriminantly. This can only result in many incorrect evaluations of reservoir properties and also waste money in testing unproductive formations. Some methods of determining per cent porosity and per cent water saturation have been oversold to the industry. Whereas the competent log specialist realizes the inherent limitations of these methods and is cautious, too many who are relying fully on the equations will arrive at erroneous conclusions. Not enough stress has been placed upon the experience factor.

No single method of determining the true resistivity of a formation will give the correct answer for all formations and for all field and borehole conditions. A combination of methods must often be employed for best results. Each method for determining true resistivity is subject to definite limitations.

Despite the limitations of the methods and some discouraging results coming from overenthusiasm and misapplications, Quantitative Loganalysis is here to stay and represents one of the industry's most valuable formation-evaluation tools.

In the fundamental quantitative approach presented in this series, the number of charts required for basic procedures has been reduced to a minimum. The simple explanatory text gives instructions for use of the charts, and examples are given. Many of the charts are new, time-saving arrangements.

To improve the determination of true resistivity, a system of three normal curves can be used in conjunction with new simplified resistivity graphs. H. Guyod, of Well Instrument Development Corp., collaborated in the preparation of these graphs.

Charts are arranged in the order of steps normally taken in Quantitative Loganalysis. Both the Humble and Archie relationships for Φ, per cent porosity, and F, formation resistivity factor, are made available. A variable "m," "cementation factor," is thus provided. A variable "n," saturation coefficient is also provided. Laboratory analyses prove that generalized equations employing fixed "m" and "n" values cannot be used for all cases and most competent log analysts prefer to vary these in accordance with experience.

QUANTITATIVE Loganalysis consists essentially of the determination of Φ, per cent porosity, and S_w, formation water saturation, from the fundamental relationships shown above.

A modified expression substitutes Φ in place of F:

$$S_w = [R_w/(\Phi^m \times R_t)]^{1/n} \text{ or,}$$

$$S_w = [(0.62 \times R_w)/(\Phi^{2.15} \times R_t)]^{1/n}$$

Analytical procedure consists of filling in the unknown to solve for one parameter. To obtain S_w, it is first necessary to determine: Φ, R_w and R_t. Methods for obtaining these are summarized below and discussed in greater detail, with charts, in the ensuing text.

SOURCES OF DATA FOR THE UNKNOWNS

R_w, Formation Water Resistivity

1. Chemical analysis of formation water converted to R_w by Chart 2.

2. Measurement of R_w, the resistivity of formation water, from produced samples.

3. Catalogs compiled for certain regions by various technical organizations.[9]

4. Quantitative analysis of the S.P. curve by the relationship:

$$SSP = -K \log_{10} R_{mf}/R_w$$

5. In 100 per cent water-saturated formations through the relationship: $R_w = R_o/F$. R_o is obtained from a corrected noninvaded resistivity curve. F is obtained from core analyses and methods given below.

F and Φ, Formation Factor and Porosity

1. Porosity averages from core analyses. Φ may be converted to F.

2. F from the microsurvey. F is then converted to Φ.

3. Porosity, Φ, from the neutron-neutron log. Φ is converted to F.

4. F from the equation: $F = R_o/R_w$, in water-bearing formations. R_o is the resistivity of the noninvaded formation. R_w is obtained as indicated above. F is converted to Φ.

5. Φ and F may be obtained under

THE AUTHORS . . .

R. G. HAMILTON

PAUL CHARRIN

For the past 7 years, R. G. Hamilton has headed Hamilton Well Log Consultants, Tulsa. Prior to that he was area manager for an electric-logging company in the Mid-Continent. He has conducted electric-logging schools in many areas of the United States, Canada, Mexico, and South America. Dr. Hamilton is a graduate of Depauw University (A.B.) and holds M.S. and Ph.D. degrees from University of Iowa.

Paul Charrin is president of Perforating Guns Atlas Corp., Houston. Born and educated in France, Charrin entered the petroleum industry in the United States. He had several years' managerial experience in electric-logging services throughout the United States before becoming instrumental in establishing the company he now heads.

favorable conditions from a short normal curve employing an empirical relationship:

$$\Phi = C \times [1/(R_t/R_m)]^{1/2}$$

R_t/R_m is the corrected 16-in. normal curve value in an invaded formation. C is a constant obtained as indicated in Part 6.

R_t, True Resistivity of the Formation

1. R_t from a lateral curve.
2. R_t from one noninvaded long normal curve.
3. R_t from invaded normal curve assuming knowledge of D_i.
4. R_t from a system of three normal curves.
5. Usually R_t is determined by each method and results compared.

Conventional electric logs comprising the S.P. curve, three or more resistivity curves, and a wall-resistivity log will usually provide all the data required to obtain an estimate of Φ, per cent porosity, and S_w, water saturation.

P.G.A.C. logs provide the S.P. curve, four resistivity curves, and the microsurvey. The Gulf Coast type of log includes two-spaced normal and two-spaced lateral curves. The Mid-Continent type of log includes three-spaced normal curves and a long-lateral curve.

The physical conditions existing around a borehole where the measurements are made are illustrated in Fig. 1.

(Continued on page 199)

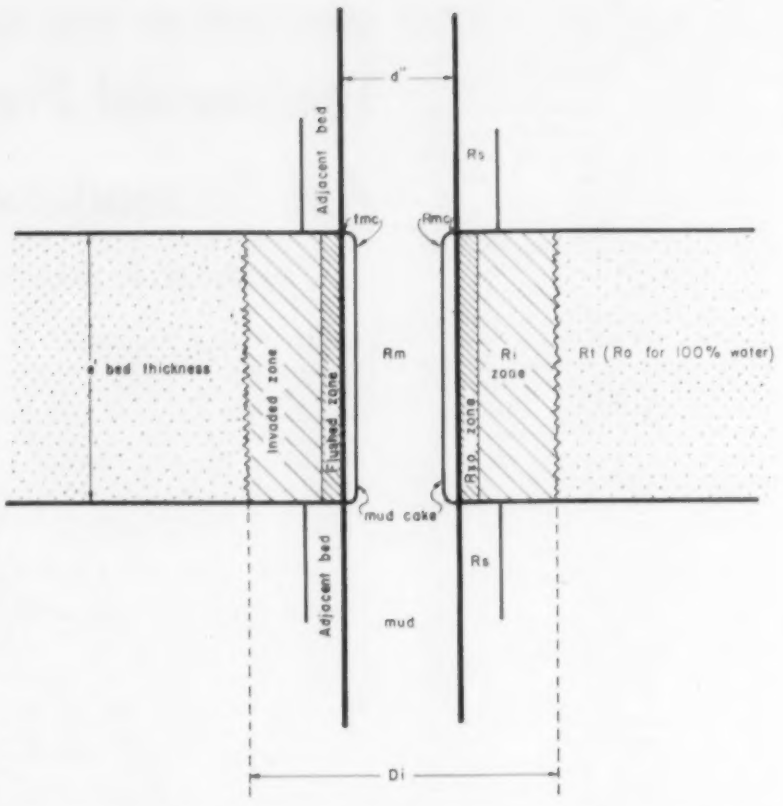

Fig. 1—Conditions around a borehole filled with mud. The primary regions affecting logging are designated by their resistivity symbol (see first page for definitions).

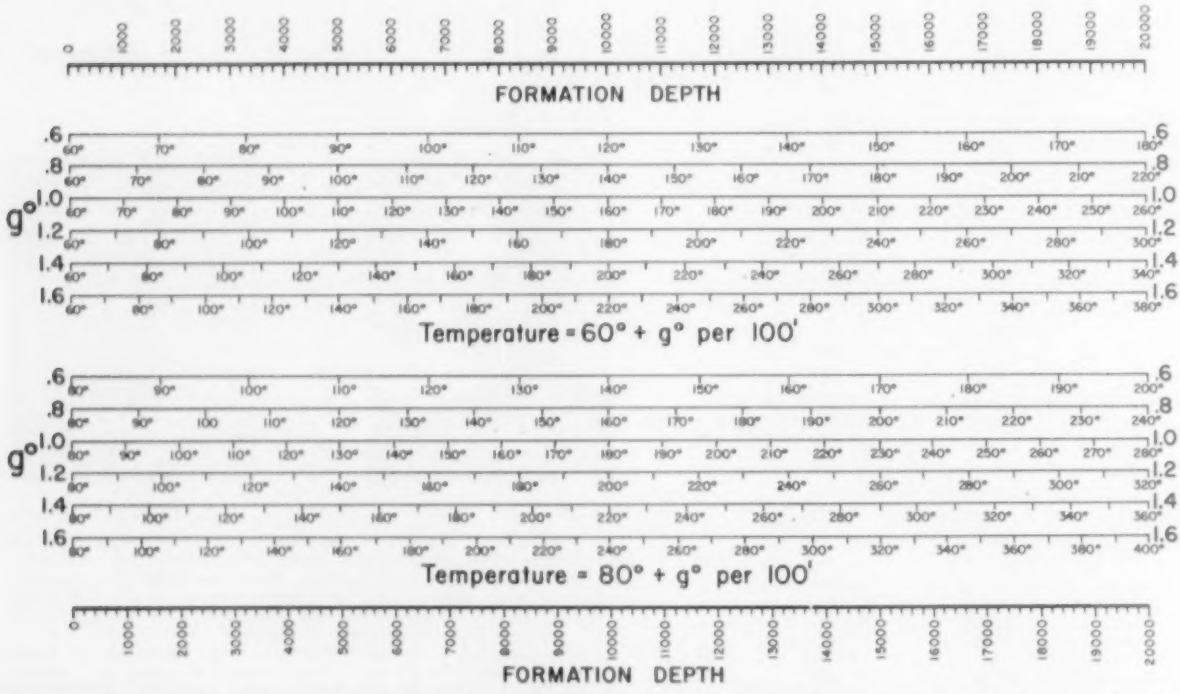

Chart 1—Select appropriate temperature gradient, degrees per 100 ft.—g°. Place rule vertically across formation depth. Read formation temperature on selected scale for a base temperature of either 60° or 80°.

Another new development using

B.F.Goodrich Chemical *raw materials*

Hycar rubber part for Baker Oil Tools, Inc. supplied by Plastic and Rubber Company, Los Angeles, Calif.

Hycar packing element fights off heat, pressure, corrosive materials to protect casing

THIS drillable production packer made by Baker Oil Tools is specially designed for sealing between casing and tubing in deep, high-pressure, high-temperature oil wells. Under these conditions an exceptional packing material is required to protect the casing from high formation pressures and corrosive substances, and prolong casing life.

The exceptional material selected was Hycar nitrile rubber. The packer is designed with drillable metal rings above and below the Hycar packing element to hold it firmly in place. As a result, the Baker Retainer Production Packer provides maximum reliability.

In actual field use this packer has been set at depths exceeding 15,000 feet, with well temperatures in excess of 325°F and pressure differentials over 7500 psi, and remained in excellent condition even under prolonged use. In laboratory tests, even higher pressures and temperatures have been endured successfully.

Hycar rubber materials are extremely tough, abrasion resistant, oil and water resistant, resilient at temperature extremes. For your tough materials problems investigate Hycar. Write Dept. EN-6, B.F.Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B.F.Goodrich Chemical Company
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LADISH

SEAMLESS

Multiple Outlet

FITTINGS

Typical fittings and piping layout of coils in a charge heater.

TO MARK PROGRESS

LADISH DESIGNED 90° AND 45° ELBOWS

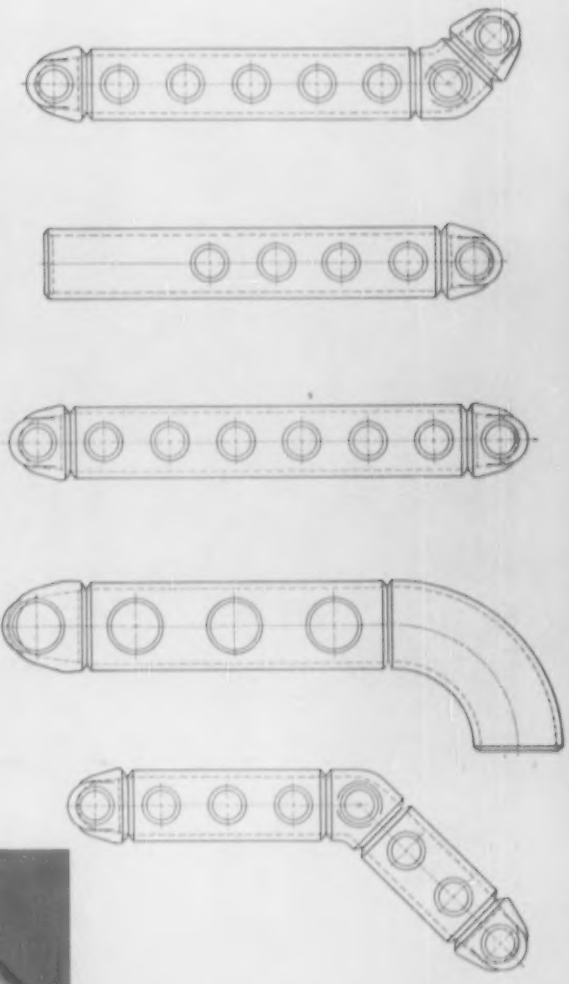
PATENT PENDING

Special die-forged Ladish 90° Reducing Heater Elbow provides a lower cost, easier to make up, final outlet and end closure. Obsoletes expensive, heavy-volume fillet weld required on straight blank-off design. Pressure drop is minimized and flow efficiency improved. Residue collecting pockets and stress risers at critical locations are eliminated. Provides ample clearance between fittings for ease of installation and more expansion allowance.

Ladish forged 45° Side Outlet Elbow effects positive savings in time and cost over the undesirable miter joint otherwise necessary. Eliminates time-consuming angle cutting and welding —then scribing, torching and nozzling-in of outlet directly over miter joint. Only two, easy-to-make circumferential butt welds required . . . deposition of weld metal at this critical juncture is minimized.

IMPROVE FLOW EFFICIENCY ... SAVE PIPING ERECTION COST IN HEATER INSTALLATIONS

Illustrated here are typical combinations of Ladish Multiple Outlet Fittings, 90° Reducing Heater Elbows and 45° Side Outlet Elbows produced to meet design requirements for heaters with varying flow cycles.

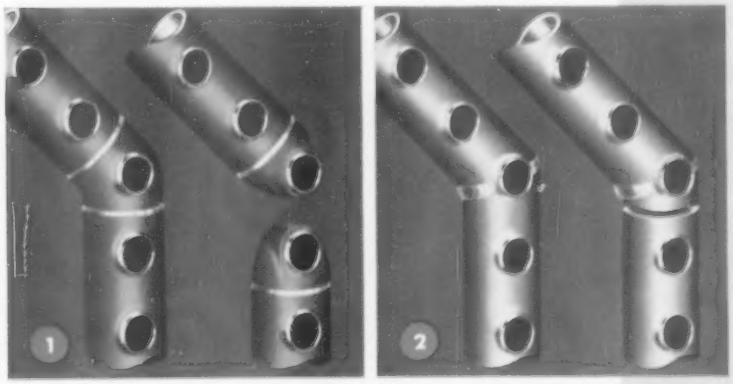


SEAMLESS Multiple Outlet Fittings developed and produced by Ladish . . . offer you significant design advantages and installation and operational economies.

Only simple circumferential welds are required to join the integral outlets to heater tubes. Expensive nozzling-in and reinforcing operations are eliminated.

Ladish 90° Reducing Heater-Elbows and 45° Side Outlet Elbows used in combination with Ladish Seamless Multiple Outlet Fittings further cut installation costs . . . improve both design and flow efficiency.

These fittings are manufactured in a wide range of sizes and material specifications to the same rigid metallurgical and manufacturing standards which distinguish Ladish Controlled Quality Fittings.



1. Ladish streamline design simplifies installation, improves flow efficiency and assures ample expansion allowance between coil sections.

2. Obsolete miter joint construction leaves insufficient space between coil sections, complicates installation, restricts expansion.

THE COMPLETE *Controlled Quality* FITTINGS LINE

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Company _____

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Combines Barton Model 199 rupture-proof bellows unit with Librascope Flow Computer. No cams, intermittent devices with built-in switch for remote reading.

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MADE POSSIBLE

THROUGH

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STEP BY STEP PROCEDURE

1. Determine	T°	Flow-line temperature, depth, and B.H.T. statistical method	Chart 1
2. Determine	R_m	Measurement	Chart 2 (Part 2)
3. Determine	R_{mf}, R_{mc}	Measurement statistical charts	Chart 3 (Part 2)
		R_{mf} and S.P. log	Chart 4 (Part 3)
4. Determine	R_w	Water analyses	Chart 2
		R_w measured	Chart 2
		Water catalogs S.S.P. equation	Chart 4, 5 (Part 3)
		R_o/F, water sands	Chart 13 (Part 6)
5. Determine	R_t, R_i	Lateral curve, 16-in. normal	Chart 6 (Part 4)
		Noninvaded long normal, normals assuming D_i, system three normal curves	Chart 8 (Part 5)
6. Determine	Φ, F	Core analyses microsurvey	Chart 10 (Part 6)
		R_o/R_w, water sands	Chart 13 (Part 6)
		16-in. normal curve	Chart 14 (Part 7)
		Neutron-neutron log	Chart 15 (Part 7)
7. Determine	R_o	Measurement calculate	Chart 16 (Part 8)
8. Determine	S_w	Calculate	Chart 16
9. Interpret	S_w	Experience, lithologic studies	Chart 17 (Part 9)

Borehole or Mud-Temperature Gradients[1,2]

R_{mf}, R_{mf}, R_w, and R_{mc} are required for subsequent calculation of Φ, per cent porosity, and S_w, per cent water saturation. These vary with temperature, thus temperature opposite the bed being analyzed must be determined. The mud temperature gradient is not identical to the geothermal gradient of the rocks except in wells that stand without circulation for many days.

Borehole temperature at any depth is given by the relationship:

$$T^\circ = \text{flow-line temp.} + [(\text{BHT} - \text{flow-line temp.}) \times \text{formation depth/TD}]$$

Mud samples are not always obtained from the flow line, thus this temperature may be unknown. Statistical plots of BHT versus TD provides G°, and the mean average flow-line temperature. If data permit, the gradient for each well should be employed. However, statistical formulas give excellent results for localized areas. Some averages are given below:

Mid-Continent:

$$T^\circ = 80^\circ + [0.8^\circ \times (\text{F. Depth}/100)]$$

Mid-Continent:

$$T^\circ = 72^\circ + (\text{F. Depth}/110)$$

Some Gulf Coast fields:

$$T^\circ = 80^\circ + [1^\circ \times (\text{F. Depth}/100)]$$

Deep Mexico and Venezuelan fields:

$$T^\circ = 100^\circ + [1^\circ \times (\text{F. Depth}/100)]$$

Chart 1 provides quickly the mud temperature at any depth to 20,000 ft. for any gradient, G°, likely to be encountered.

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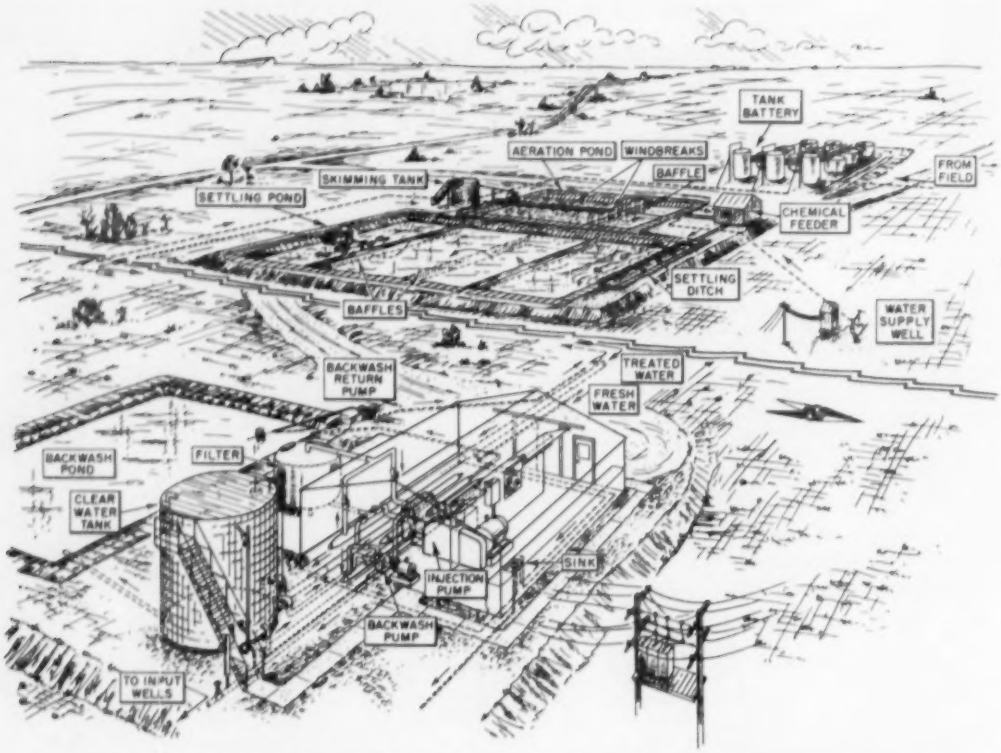

WATER-TREATING PLANT of Tidewater Oil Co., Hull lease, Blankenship project, Greenwood County, Kansas.

Water Flooding in Butler and Greenwood Counties, Kansas—3

Tidewater's Blankenship Water-Treating Plant

Treated water prepared in this plant is used in the 800-acre Blankenship-Sallyards pool flood described in the August 27 issue of The Oil and Gas Journal, page 95.

by Jack P. Powell

BRINE for Tidewater's Blankenship flood is obtained from a supply well completed at a depth of 3,570 ft. in the Arbuckle limestone. The well has a string of 8⅝-in. casing cemented at 2,990 ft. with 650 sacks of cement. Hole is open from this point to 3,570 ft.

Static water level in the well is at 530 ft. A 75-hp. submerged electric pump on 4-in. steel tubing is set at 1,800 ft. and delivers the brine to the surface and thence through a 4-in. transite pipe to the aeration pit.

Brine produced from the oil wells also is used in the flood and is collected in a central tank battery located near the aeration pit. The produced brine from the separating tanks flows into a 200-bbl. skimming tank to remove any oil that might have been carried through with the water. From the skimming tank, it flows through a spray-type aerator into the aeration pond where it is mixed with the Arbuckle brine.

The Hull plant constructed in 1955 is the more modern of the two water-treating plants and will be described in detail. The method of treatment does not differ greatly in the two plants. The design of the Hull plant is shown in the sketch.

Aeration used . . . Hydrogen sulfide is removed from the Arbuckle brine by aeration through use of a spray system. Water from the supply well is forced into a 4-in. steel header in the middle of the aeration pond, and supported above the surface by redwood posts. Brine enters the header at a pressure of 25 psi. and is sprayed into the pit through 1-in. plastic nozzles. About 25 double nozzles are used to aerate about 5,500 bbl. of water per day. The pressure is regulated by varying the number of nozzles in use.

Both the 1-in. couplings to the nozzles and the steel header have been coated with plastic resin paint to prevent corrosion. The nozzles are located 1 ft. above the surface of the pond and at the pressure applied, water spray travels about 15 ft. through the air before it drips into the pond. Evaporation and carryoff by the wind are minimized by 6-ft.-high baffles made of corrugated asbestos sheeting.

The aeration pit, which is 50 by 90 by 5 ft., is lined with sheets of an asphaltic sealing material to prevent water seepage. At the water's edge, the surface of the sealant is plastic-coated

Author is petroleum engineer, U. S. Bureau of Mines, Bartlesville, Okla. Data from USBM information circular.

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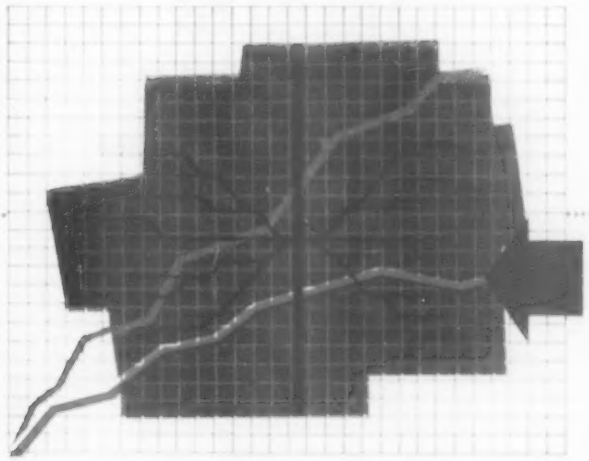
CUTS COSTS OF BIG VOLUME FRACTURING



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Big volume fracturing may sound expensive, but it needn't be...if you specify Halliburton's SANDOIL fracturing. SANDOIL gives you big volume with big economy. That comes from Halliburton's unmatched combination of research to develop better low-cost fracturing fluids and more efficient equipment... capable of continuously pumping huge volumes at high pressures... plus the know-how that comes from 7 full years of experience in fracturing oil and gas wells for big production increases.

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SANDOIL'S economy on big fracturing jobs is made possible by using inexpensive, readily obtainable crude or refinery cuts and blends. A wide range of treating procedures developed by Halliburton to meet different well conditions provides techniques for maintaining required viscosity, fluid loss and compatibility... three important factors in any fracturing job.

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Further effectiveness is gained by Halliburton's continuous blending and proportioning equipment. This provides for: 1. Changing sand concentrations over wide ranges at any time during the fracture treatment; 2. Controlling and measuring the sand concentration going into the well at all times; 3. Mixing large quantities; 4. Operating at high rates of injection.

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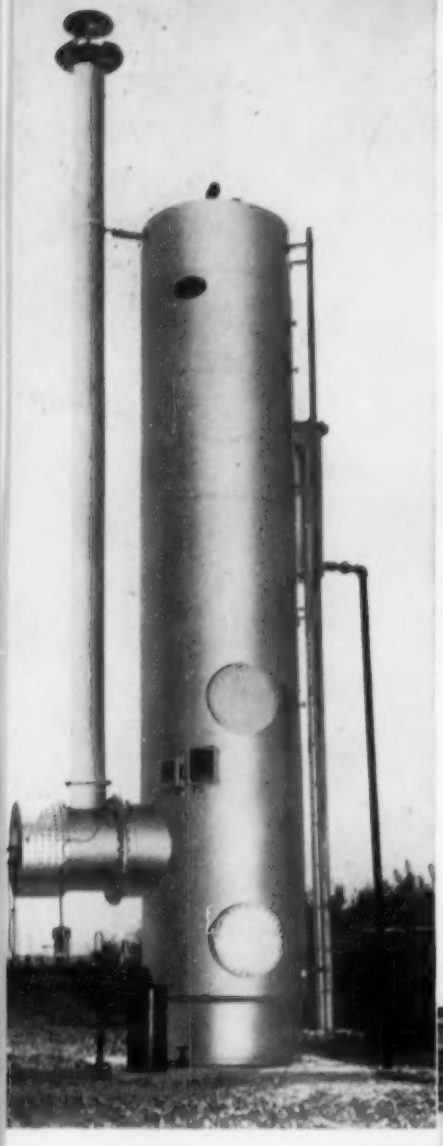
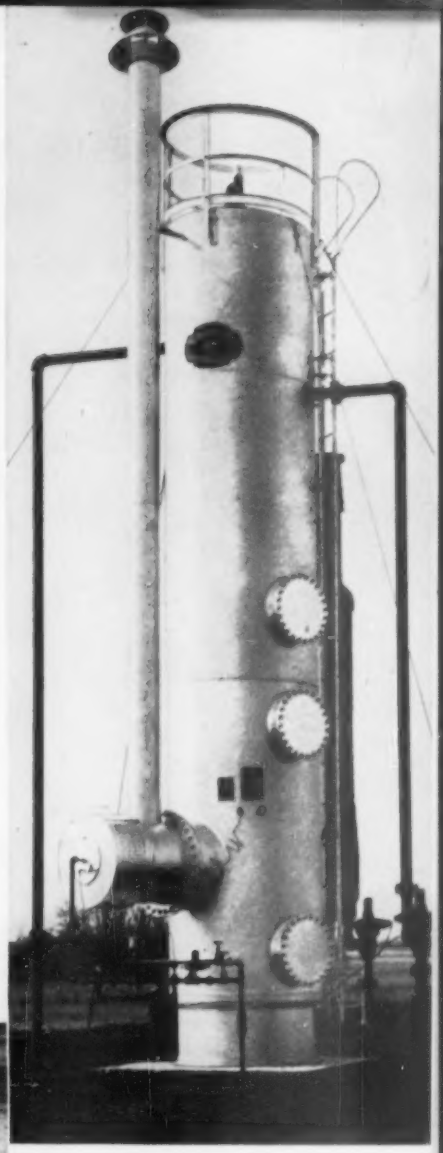


There's a PARKERSBURG TREATER *for every requirement*



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Moreover, from Parkersburg's extensive line of emulsion treaters, you get better emulsion and free water separation; more effective emulsion breakdown; more specific separation of emulsion into clean oil and water; greater maintenance of high gravity oil through conservation of lighter fractions.

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MINERAL ANALYSES OF FLOODING WATERS, TIDEWATER OIL CO. BLANKENSHIP PROJECT, BUTLER AND GREENWOOD COUNTIES, KANSAS

Radical—	Supply well— P.p.m.	Supply well— Reacting values in per cent (Palmer)	Produced brine— P.p.m.	Produced brine— Reacting values in per cent (Palmer)	Mixed brine, untreated— P.p.m.	Mixed brine, untreated— Reacting values in per cent (Palmer)	Clear water— P.p.m.	Clear water— Reacting values in per cent (Palmer)
Calcium (Ca)	3,000	8.29	6,400	8.78	4,100	8.15	3,890	8.99
Magnesium (Mg)	1,210	5.51	1,715	3.85	1,470	4.81	987	4.03
Sodium (Na)	15,000	36.20	44,900	37.37	21,400	37.84	18,400	36.98
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Bicarbonate (HCO_3)	250	0.23	121	0.05	164	0.10	165	0.13
Sulfate (SO_4)	107	0.12	192	0.11	166	0.14	376	0.36
Chloride (Cl)	31,800	49.65	64,300	49.84	44,200	49.76	37,900	49.51
Total solids	51,367	100.00	117,628	100.00	71,500	100.00	61,718	100.00
Hydrogen sulfide (H_2S)	None		None		None		None	
Barium (Ba)	None		None		None		None	
Specific gravity	1.037		1.078		1.052		1.048	

to eliminate the softening by any oil that might escape from the skimming tanks.

Chemical treatment . . . From the aeration pond, the water flows in an 18 by 18-in. cement-lined ditch into the chemical building. There lime is fed into the water by a dry-type chemical feeder to aid in regulating the pH of the water and to stabilize carbonate saturation. The water flows by gravity from the chemical building in an open ditch 1½ ft. deep by 6 ft. wide, sealed with asphalt membrane.

Cement blocks placed at 2-ft. intervals in this ditch serve as baffles to aid in mixing the water and lime. The ditch is large enough to provide adequate detention time for much of the precipitated solids to settle out before the water flows into the settling pond.

It is easier to remove the sludge from the ditch than from the settling pond. That can be done only by shutting down the entire treating system.

A row of cement blocks placed 1-in. apart forms the inner bank of the settling ditch, and between these blocks the water flows into the settling pit. The settling pit (80 by 190 by 10 ft.) also is lined to prevent seepage.

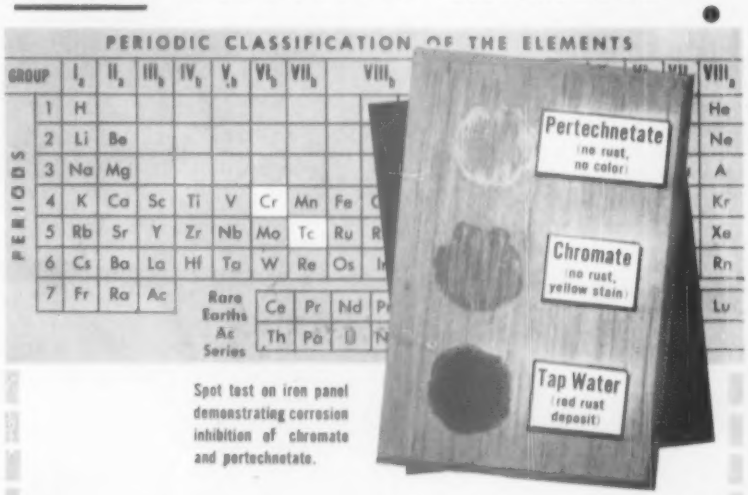
Three corrugated asbestos baffles extend across the pit at intervals to regulate the flow of water through the pit. The first and third are under baffles, 6 ft. high, with their bottoms 18 in. above the floor of the pit. The second baffle is 3½ ft. high and is set on the floor of the pit to act as an over baffle.

The joints of the asbestos sheets in each baffle are caulked to prevent water seeping through the barriers. When the system is operated at full capacity, the pit will provide approximately 3 days' detention time for settling.

Filtering . . . The water flows by gravity from the pond to the filters through approximately 900 ft. of 10-in. pipe. The inlet to this line is a 60-ft. section

. . . what is your

best corrosion inhibitor ?



Spot test on iron panel demonstrating corrosion inhibition of chromate and pertechnetate.

Recent research* with a very rare man-made metallic element called technetium has shed new light on the mechanism of corrosion inhibition.

Experiments have demonstrated that even in concentrations as low as 5 ppm and at temperatures of 450° F., pertechnetates completely inhibit iron oxidation. But technetium is a synthetic element obtained by bombarding molybdenum with deuterons, or in the fission of uranium as a fission product. As a result it is extremely scarce and prohibitively expensive.

Fortunately, chromates have an ionic structure very similar to that of the pertechnetates, permitting dependable and efficient corrosion control at a tiny fraction of the cost of technetium compounds.

Mutual Chromium Chemicals have been widely used for corrosion control for many years, during which time we have accumulated much useful experience. May we help you with your corrosion control program?

*Sci. Am. 194, 35-39 (May 1956)

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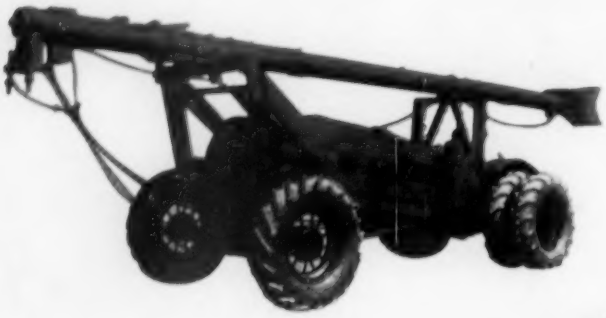
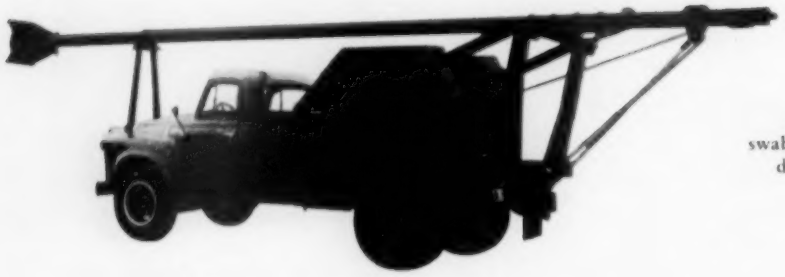


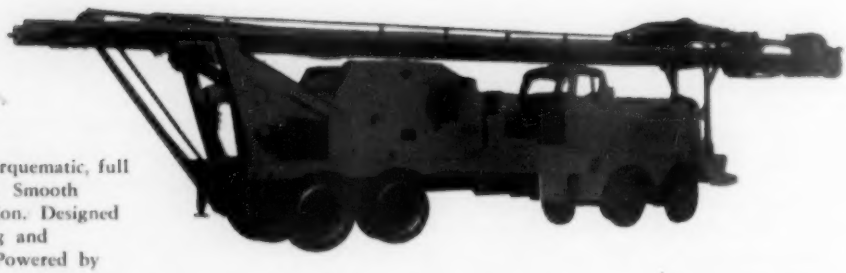
Model E-563 — the only tractor servicing unit built. Unsurpassed for use in mud, sand and over rough, hilly terrain.

Ruggedly constructed for efficient servicing in localized areas. Built in one size only — rated to 6,000 feet.

Model TR — Truck engine powered — Adaptable to any standard truck. Proper weight distribution for legal axle loading. Fast and efficient on the job or on the road. Ideal for wide radius operations. Four sizes, single or double drum for any depth servicing or workover to 10,000 feet.



Model TR — Truck engine powered swabbing unit. A low cost unit especially designed for swabbing. Highly portable — fast to get on and off the job.



Model T 420 Torque converter, torquematic, full torque shifting transmission drive. Smooth shock free power for every operation. Designed for the toughest jobs of servicing and workover on the deepest wells. Powered by diesel or gas — gasoline — butane engines.

Optional equipment includes single or two pole telescoping pipe masts, fabricated masts, spudders, rotary drives, power steering, catheads, drum dividers, etc.

Originator of Mobile Winch Units

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of 5-in. pipe supported in the pond by eight 55-gal. drums.

An 8 by 3½-ft. permeable-plate type of filter is used. The plant is now operating at only 50 per cent of capacity (5,000 bbl. per day) so only one filter is used. Later when the quantity of water required increases a second filter will be installed.

The filter is backwashed daily with a 5 by 4-in. centrifugal pump. The backwash water flows into a lined pit (30 by 30 by 5 ft.) where the suspended matter is allowed to settle. Then it is returned to the aeration pit by a 1½ by 1½-in. centrifugal pump.

The filtered water is stored in a 500-bbl. wooden tank which is connected to the intake line of the main water pumps. A horizontal-triplex pump with chromaloy pistons powered by a triple-rated electric motor, pumps the treated water at a pressure of 300 psi. through the distribution lines to the input wells.

. . . Many safety devices are used throughout the system. Automatic mercury switches shut down the injection-pump motor whenever the discharge pressure rises above or declines below predetermined values. A similar switch is on the oil-pressure system of the water pump and a shear-pin relief valve is on the high-pressure side of the pump.

Low-level liquid electrodes in the clear-water tank operate a warning siren. A metal partition between the injection pump and the motor and its controls prevents water from contacting any electrical equipment in case of a leak.

A field water-analysis laboratory is installed in the pumping plant building. Mineral analyses of water samples taken at various points throughout the treating system are given in the table.

Don't forget to check . . .

The Journal's Engineering Reference section each week for practical on-the-job information. The section is a regular feature covering all divisions of the oil industry.

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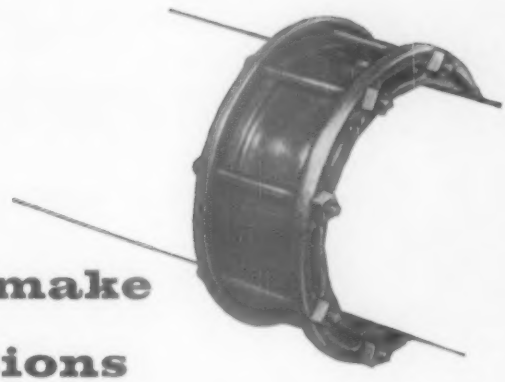

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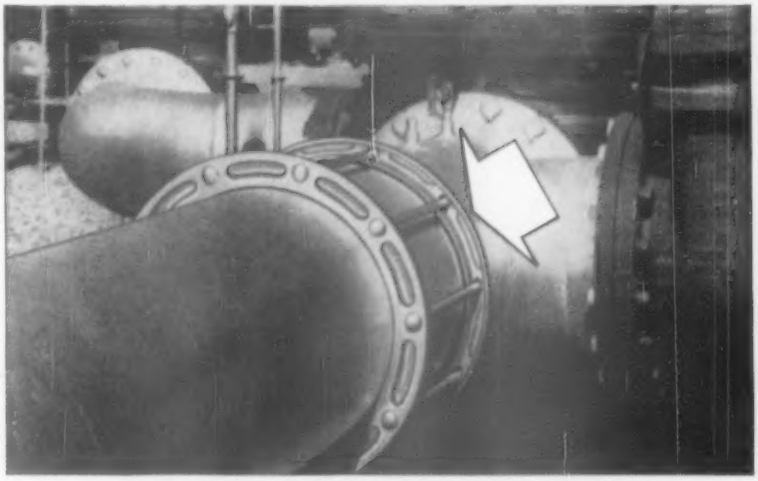
A 16" Dresser Coupling on a water jacket in a field processing plant



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ELEMENTS OF FIELD PROCESSING—21

TEMPERATURE CONTROL—1

by Dr. John M. Campbell

THE heaters used in oil production operations may be classified into several categories:

1. Heated fluid passes through heater.

A. Indirect type, using: (a) water, (b) heat-transfer oil, (c) eutectic salt.

B. Direct type.

2. Heating medium circulates

A. Hot water

B. Low-pressure steam.

C. Heat-transfer oil, Dowtherm, etc.

An indirect heater is basically a device whereby the burner heats a fluid bath which in turn heats the fluid passing through the flow coils. In this manner the hot flame is isolated from the hydrocarbon which minimizes coking and burnouts and increases the ultimate safety. The choice of fluid bath is of course a function of the temperature range desired. *(Part 6, The Oil and Gas Journal, September 12, 1955).*

From a control standpoint the large mass of the liquid bath used complicates the problem, particularly if accurate temperatures are required. On oil and gas lines where only approximate temperatures are needed it is usually sufficient to control the bath temperature. However, where the heat output must vary, a controller must be placed on the flow coil, for the bath acts as a "heat sponge" and prevents rapid response to the temperature pilot.

Author is with School of Petroleum Engineering, University of Oklahoma, Norman.

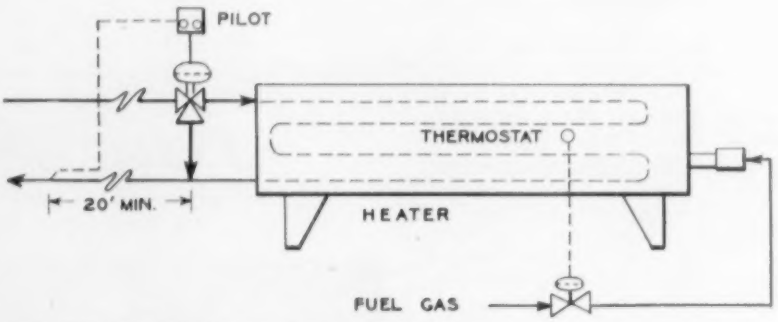
On-off control . . . Contrary to the usual situation, the simplest instrument is usually the most desirable for control of an indirect heater. In fact not over 10 per cent proportional control is recommended because the bath temperature would always lag behind the controller. This could be overcome by using an instrument with derivative response but the cost would not be justifiable. In this application reset would not be needed in any event.

A thermostat of the type shown in Fig. 1 is very satisfactory in this service. The probe mounted in the vessel consists of an invar rod within a stainless-steel tube. Changes in temperature will change the length of the tube but have very little effect on the invar rod. The relative movement of these two elements then controls the action at pilot seats (1) and (2).

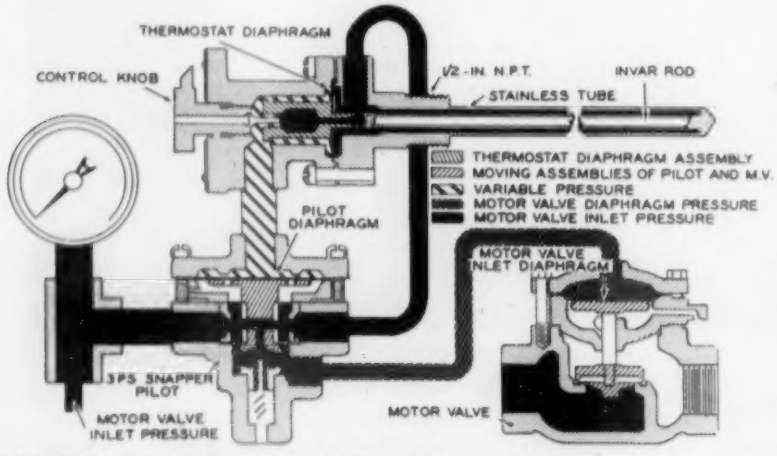
In the particular model shown the thermostat action then actuates a snap-acting pilot which in turn operates a simple diaphragm valve. Using this means of control the burner is either on or off. From the control standpoint alone this is desirable for it enables the fast transference of heat to the relative large mass represented by the liquid bath. On large heaters, though, the large surge of gas when the valve opens is sometimes felt to be undesirable and some degree of throttling is needed.

Varying flow rate . . . When a control is needed on the fluid through the coil the thermostat shown in Fig. 1 is not entirely satisfactory, particularly if the flow rate varies widely. It may give good results in cases where the loading is relatively constant, when equipped with a proportional pilot.

It has been found necessary in many cases to add reset in order to hold the temperature at the control point and derivative response to compensate for the time lag inherent in the system. Fig. 2 is an example of this type of control. The thermostat holds the bath temperature at the predetermined level, preferably greater than 50° F. above the desired outlet temperature. The three-way valve then bypasses enough of the cool fluid to give the desired outlet temperature. Under design conditions some fluid should be bypassed so that control in both directions is provided.



THIS CONTROL SYSTEM, containing reset and derivative responses, is necessary for some heater installations. Fig. 2.



CONTROL OF AN INDIRECT HEATER can be accomplished very satisfactorily with a thermostat of this type. Fig. 1.

The temperature sensing bulb should be at least 20 ft. from the bypass point to allow mixing of the streams. This is an inherent disadvantage of the system for it introduces a time lag that often must be corrected by derivative response.

The three-way valve may be replaced by a less-expensive two-way valve located on the bypass. This valve must be carefully sized, for the pressure drop

is small through the heater coil and consequently it has to operate on a small pressure differential. In the final analysis the three-way valve is usually worth the extra investment because of the flexibility it affords.

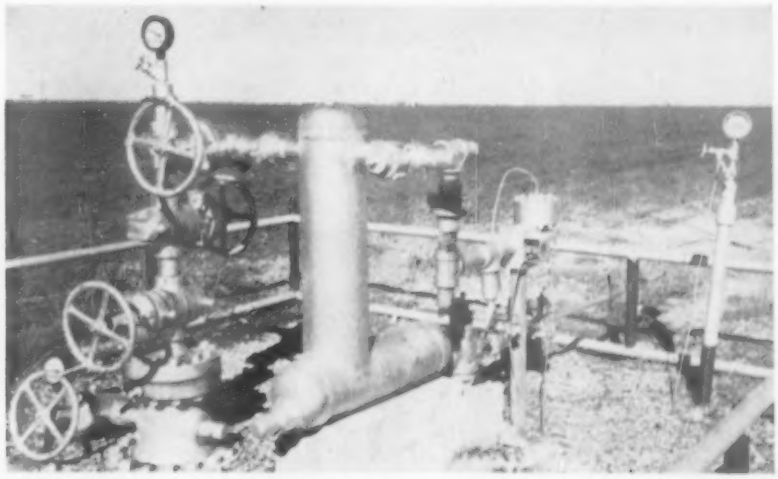
Direct-Fired Heaters

In direct-fired heaters no buffer solution is used between the fire and the flow tubes, the heat being transferred by direct flame impingement, radiation from the flame, and the hot exhaust gases. They offer the advantage of very positive heat transfer since the mass involved is relatively small. Their chief disadvantage stems from the large temperature differential that exists across the tube wall which increases the danger of hydrocarbon coking, fouling, and ultimate failure of the tubes. It is for these reasons that they have been used largely in plants where they could be supervised and high heat loads per unit volume are encountered.

The basic system usually consists of a temperature pilot on the fluid outlet that controls the gas to the burner. In the event that this control fails, a high-temperature shutoff is used to prevent heater damage. A proportional pilot customarily is used, for it gives good control and minimizes thermal stresses in the flow coil. The manufacturers of tubing discourage the use of on-off control, for repeated heating and cooling sets up stresses that can ultimately cause failure. Recent metallurgical developments, however, have minimized this problem.

The need for derivative response would normally be less than with the indirect type but reset would still be required for varying flow rates.

ON THE JOB . . . . . IN THE FIELDS



AN L-SHAPED PIECE OF 8-IN. PIPE with a 2-in. inlet and outlet makes this sand trap.

Sand trap made from 8-in. pipe

TO eliminate produced sand from this gas-condensate well in Bloomington field of Victoria County, Texas, Rock Hill Oil Co. made and installed this sand trap. It is simply an L-shaped piece of 8-in. pipe with a drain connection on the bottom and a 2-in. inlet and outlet near the top. The inlet has an ell on the inside with a short nipple turned down and the outlet has an ell looking up. This makes the fluid turn through 360° to get to the outlet line. The heavy-sand particles cannot follow this path and drop out.

The scrubber sits on a concrete block which prevents any strain on the tubing. A 1-in. bleeder line on one end of the bottom of the ell allows sand to be blown out with well pressure. The 2-in. collar on the other end provides a means of punching out any sand.

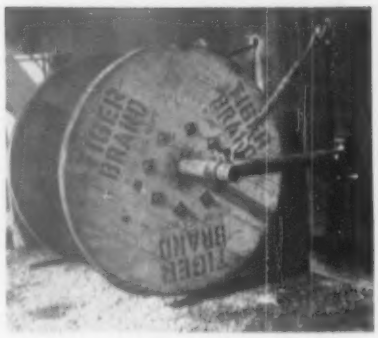
The choke and the regulator works downstream of the sand trap where they will not be cut out by sand.

Turnbuckle lifts spool

AT this Rocky Mountain Drilling Co. rig, at work on a wildcat near Los Angeles, handling of heavy wire-rope spools is simplified by turnbuckle supports.

When a new drilling line is to be installed or the rig dismantled for a move, the turnbuckles are expanded until the spool rests on the ground.

Tightening the turnbuckles lifts the spool clear of the ground, keeping the line out of the mud. The line is run through the enclosed substructure via a 3-in. pipe conduit to a dead-line anchor on the derrick floor.



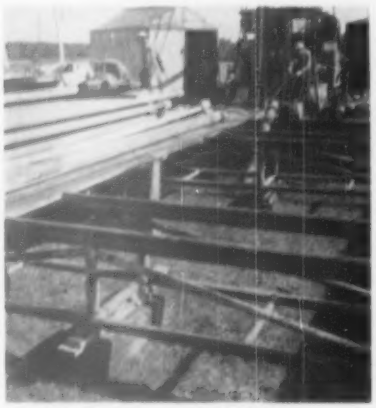
TURNBUCKLE holds heavy wire-rope spool.

One-piece pipe rack used for moving bins

NOW a one-piece pipe rack is used by Turner Drilling Co., Mount Pleasant, Mich., which can be used later for bins to hold short pieces of pipe together for moving. The racks extend under the cat walk and have 2-in. pipe welded on top to make them level with the planks.

Where shallow holes are drilled and the rig moved every few days, the racks allow quick rigging up and tearing down.

Each of the two racks has two sections which meet in the center of the walkway. For moving, they form four packages into which joints of water and fuel lines can be placed while the rig is being taken down.



PIPE RACKS hold fuel lines while moving. They are made flush with walkway.

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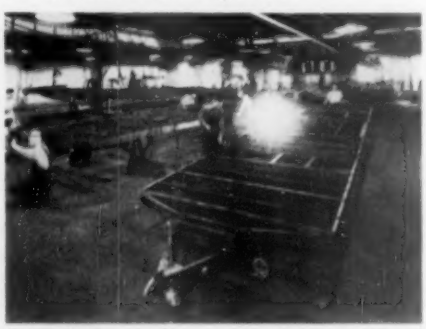

Foundation or frame is rugged, unitized steel construction . . . one-piece continuous roll-form steel longerons, and electric-welded cross members and gussets.

JOINTS OF TUBING can be slipped back and forth easily by R. A. Lowery, Shell Oil Co., with help from his new device.

CLOSEUP of the machine shows how slip and roller raise or lower.

New tubing rack promotes safety

. . . handling of pipe is prevented

A SAFER, quicker, and considerably easier way to stack tubing as it comes out of the well has been developed by R. E. Lowery, Shell Oil Co.

The method is quicker for latching the tubing in the elevators as it goes back in the well also. Consisting mainly of a detachable portion of the tubing rack which contains a ball-bearing roller and can be raised and lowered, the device makes the hazardous work safer.

The detachable section is installed so its edge is flush with the stripping on the top layer of tubing on the rack. Individual joints of tubing may be easily, quickly, and safely rolled on and off the roller. While on the rollers (one at each end of the rack), the stand can be positioned for stacking or for the elevator. It can then be rolled into the slip or onto the bed of the rack.

The function of the movable part of the device is to keep the joint of tubing being worked on at the same level as the top layer of tubing in the rack. This prevents the necessity of lifting tubing at any time by hand. Injuries to the hands or feet due to dropping or sliding tubing are prevented.

LOADING PLATFORMS are slipped into place on railroad gondolas before operations begin.

Platform helps loading

EMPLOYES in the coastal division, purchasing and stores department, of Shell Oil Co. have developed a portable safety platform for men working on pipe-loading operations on railroad gondolas at Ventura.

Noting that men engaged in such work had only a 4-in. ledge 8 ft. off the ground on the edge of the gondola to use for standing, the purchasing and stores department employes drew up plans for a welded steel platform.

This platform can be slipped into place on the gondola by the loading crane before operations start. The loading crew has ample room for their work and the operation is much safer than the old method.

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by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

Amount of Propane and Butanes Formed During Catalytic Reforming

In your answer of January 3, 1955, "Yields by Platinum Catalyst Reforming," you show that large amounts of butane are needed in producing 10-lb.-R.v.p. reformate. Where are such amounts obtained?—R. A. N.

During mild reforming (82-95 per cent pentane-plus reformate) not enough butane is produced to produce a 10-lb.-R.v.p. gasoline or reformate. The deficit may amount to even 15 per cent based on feed stock. The general situation is indicated in Fig. 1. The Sinclair-Baker catalyst seems to produce the largest amount of pentane-plus reformate and this results in a large deficit of butanes. At the other extreme, Platforming and the Atlantic processes produce more butanes and when operating at great severity (up to 85 per cent pentane-plus reformate) an excess of butanes is produced. Ultraforming appears to fall between these two extremes.

TABLE 1
Butanes (and Butylenes)* Produced and Amount of Butanes Required for a 10-Lb. R.v.p. Gasoline (Liquid Volume Per Cent of Feed)

Yield of debutanized reformate	—Yield of butanes*— Sinclair-Baker and Powerforming†	Atlantic†	Butanes required for 10-lb. R.v.p.
75	9.0		8.6
80	6.5	14.1	10.0
85	4.1	9.4	11.6
90	2.2	5.1	14.0

*Scant information indicates half or more butylenes. †Platforming and Ultraforming yields appear to lie between these extremes.

With respect to propane formation, all of the platinum-catalyst processes appear to behave much the same (see lower part of Fig. 1). Information is not very complete but two major references are (1) Fowle et al., "It's the Catalyst That Counts," The Oil and Gas Journal, May 26, 1952; and (2) Teter et al., "New Catalytic Reforming Process," The Oil and Gas Journal, October 12, 1953.

Some ethane is also produced and, of course, hydrogen constitutes the major volume of the gas production. Ordinarily, the production of butanes and propane is a detriment.

The amount of butanes (and butylenes) produced is indicated in Table 1, as well as the total volume of butanes required to attain a 10-lb. R.v.p. (all as liquid percentage of feed stock). The degree of accuracy is somewhat the same as in Fig. 1.

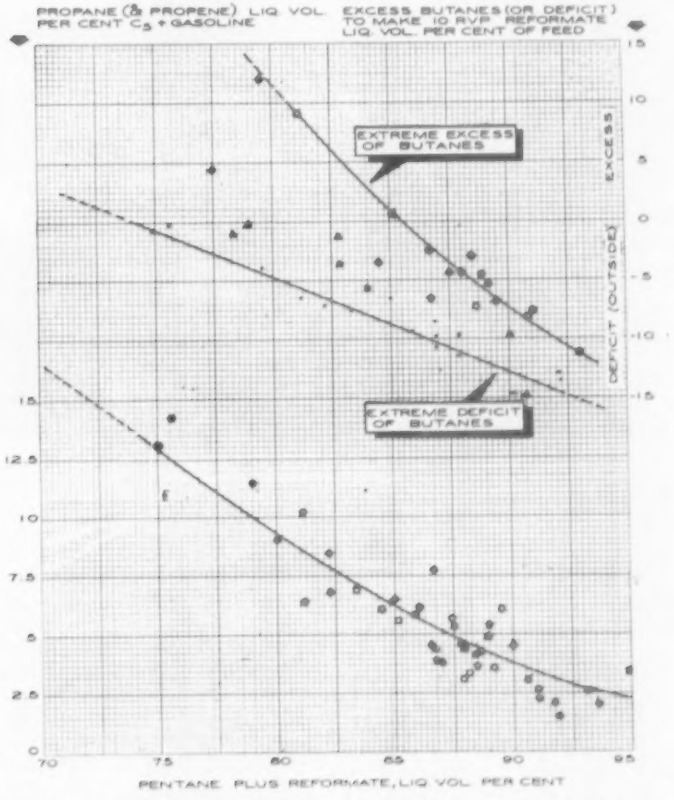
PROPANE (& PROPENE) LIQ. VOL. PER CENT C_3 + GASOLINE
EXCESS BUTANES (OR DEFICIT) TO MAKE 10 RVP REFORMATE LIQ. VOL. PER CENT OF FEED
EXTREME EXCESS OF BUTANES
EXTREME DEFICIT OF BUTANES
EXCESS
DEFICIT (OUTSIDE)
PENTANE PLUS REFORMATE, LIQ VOL PER CENT

Fig. 1—Amounts of propane (and propene) and BB cut produced in platinum-catalyst reforming.

Toluene as Blending Stock For Motor Fuel

We are interested in learning the current usage of toluene as a blending agent in the manufacture of aviation gas, premium gas, and possibly regular gas. What percentages of toluene can be economically used? How many research octane numbers can toluene add to different components such as straightrun, thermal, and catalytic gasolines and possibly alkylate, polymerate, etc.? I. F. S.

Although answers could possibly be secured by a search of the literature, it is doubtful if pure toluene as such can be used at all as a blending agent, or if so, it is a mistake to do so because toluene as part of a mixture with benzol, xylols, etc., can be produced at less than one-third of the market price of toluene. The platinum catalytic reforming processes which have been installed in most refineries during the last 2 years produce large amounts of impure toluene and it thus enters nearly every refinery gasoline.

The octane numbers of toluene are:

Motor method, isooctane + 0.27 cc. TEL.

Research method, over 100.

Research (blending), 123.5.

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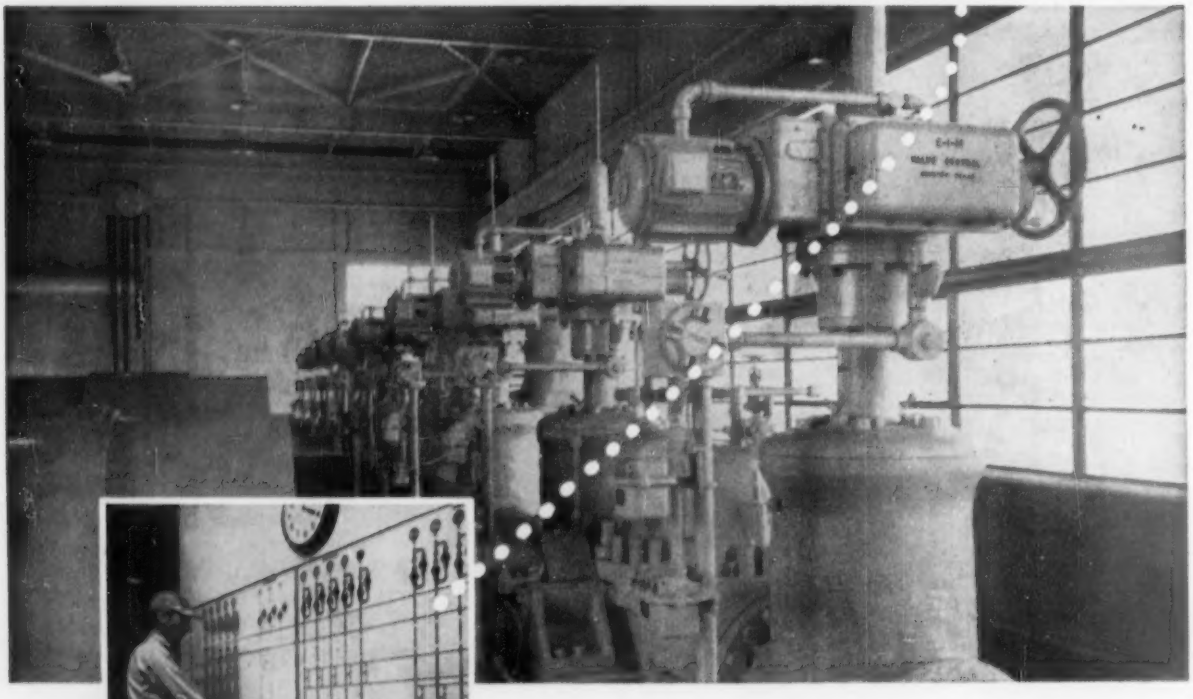

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by Dave Vondy

SPHERICAL PROCESS VESSELS—2 **Part 1**

Spherical Vessels Have Many Advantages

HOW much the operational difficulties discussed cost an operating company is difficult to evaluate. In some instances it is known to exceed the equipment cost! When operating personnel are tied up with difficulties, their time is wasted and other duties must be neglected. How expensive is it when a slug of condensate goes down the gas line and what additional trouble will it cause?

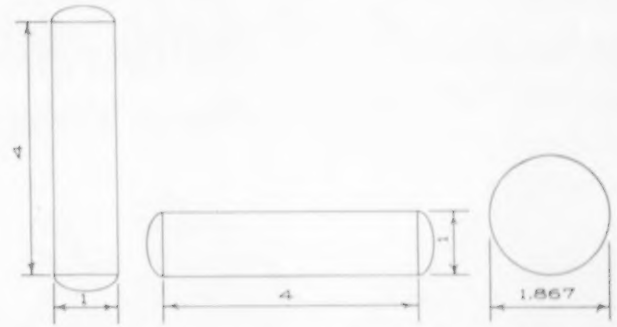
A spherical or vertical vessel properly designed eliminates most of these difficulties. The level gage shows a true level and gives no trouble except when plugged with hydrates. Furthermore, plugging of downcomers with wax or mud cannot occur.

Somewhere back in the early days of separator design someone came up with the idea that the mist extractor in a vertical vessel should be designed with a drainback pipe extended into the liquid in the bottom of the vessel. Until recently, all or nearly all manufacturers built vertical separators this way; yet this design has cost producers untold quantities of recoverable liquid. Any time that the pressure drop through the mist extractor element is excessive for such reason as: partial plugging, bad construction, or over capacity, most and usually all of the liquid is lost to the gas line.

Design . . . However, the function of the mist extractor is to remove only a small portion of the total liquid, the bulk being separated from the gas below the extractor. Design whereby only the mist is lost upon failure of the extractor is simple and although it is sometimes a problem to determine that the mist extractor is functioning properly, this design is certainly superior.

Some mist-extractor elements require several feet of liquid seal which necessitates vertical-vessel design. Recent design using an element of wire or ceramic balls eliminates this seal problem while a safety bypass can be incorporated to protect the structurally weak extractor element.

Author is with Constructive Engineering, Baton Rouge, La.



PRIMARY ADVANTAGE of a spherical vessel over a cylindrical vessel is its lower steel content.

A primary advantage of a spherical separator over a vertical is that a larger portion of its volume can be used more effectively for the purpose of primary separation; therefore it has a higher capacity.

Advantages in other applications . . . Before use in any new service, an analysis should be made to determine if the spherical vessel will show advantage; it certainly is not the universal answer. Several specific cases are discussed in this series.

For pressure storage tanks, spherical design is often most economical. Shop-fabricated tanks must be limited in size to permit transportation by available facilities.

Field-welded tanks are usually limited to large 15 to 150-psi. spherical vessels; if a tank can be built horizontally in a shop, it may be less expensive than if spherical field welded. Where transportation from a shop is not over an excessive distance, where there is adequate clearance along the route, and when adequate transportation facilities are available and facilities for economic fabrications are available, then shop fabrication of quite large spherical vessels is practical.

The accompanying table gives spherical-tank diameters for various capacities, illustrating the relatively small diameter and the amazingly thin shell.

An interesting application of spheres is in surge-vessel service. Consider first a vertical vessel to which liquid is fed and in which a constant pressure is maintained by gas supplied from an external source. The purpose of the vessel is to even out the flow of liquid which is discharged to a fractionator by a simple liquid-level controller and control valve. The controller pilot is set to fully stroke the control valve with a level change over the full height of the vessel which results in use of only about half of the vessel volume for normal surge.

TABLE I—SPHERICAL-TANK DIAMETERS FOR VARIOUS CAPACITIES

Capacity (gal.)	Spherical tank (i.d.)	Required shell thickness (A.P.I.-A.S.M.E. code, 70,000 psi. T.S.)—design pressure, psi.		
		25 no X-R	100 X-R	250 X-R
5,000	10 ft. 11 in.	0.0938	0.209	0.521
10,000	13 ft. 8 in.	0.0938	0.261	0.652
15,000	15 ft. 8 in.	0.0938	0.299	0.747
20,000	17 ft. 3 in.	0.0938	0.329	0.823

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M-3 Bullet Guns Penetrate 7.175" of Casing and Cement for 30 B/D

The operator of this shallow California well wanted to test a 35 foot upper zone that lay behind two strings of cemented casing. Interval to be perforated was from 1800' to 1835'. Casing at this point was 8⅝" O.D. 36 lb. cemented in 11¾" O.D. 54 lb. which was cemented in 15" open hole—a minimum of 7.175" of steel and cement had to be perforated if the 15" hole was exactly to gauge.

At first the operator was very skeptical that any bullet perforator would have the penetrating power to accomplish the job. However, after reviewing penetration data and performance records, he decided to use McCullough M-3 Bullet Perforators.

128 improved ½" Ogival Bullets were fired in the 35 foot zone by 4¾" O.D. McCullough M-3 Bullet Guns. Total time on the job was only one hour and 45 minutes. Adequate penetration was accomplished without question, since 30 barrels of oil per day are being produced from the new zone—a good well for the field.

M-3 Bullet Perforators are the original solid steel bodied bullet guns, pioneered and developed by McCullough Tool Company. Size for size they are stronger than any other bullet gun available—have greater firing power—give you deeper penetration.

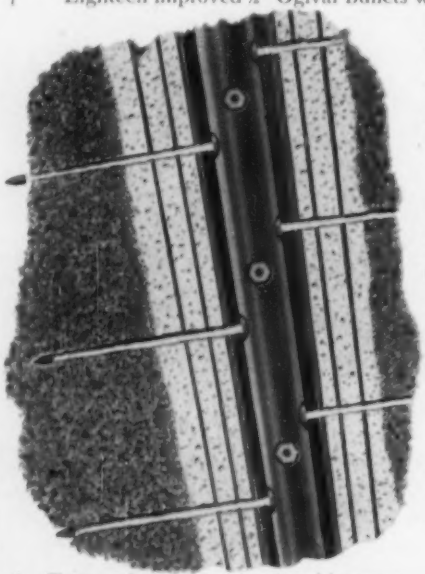
Hardest Shooting M-3's Penetrate Three Strings For a Good Well

Powerful M-3 Guns, Firing Improved Ogival Bullets, Penetrate Multiple String of 7", 5½" and 4½" O. D. Pipe for Good Production.

Few perforating companies will attempt three string penetration with a bullet gun with any reasonable assurance of success. An exception to the rule is McCullough Tool Company. Recently, powerful M-3 Bullet Perforators were used to perforate a newly discovered thin zone lying behind three strings of pipe. Another service company, first offered the job, would not attempt such penetration.

This was a shallow South Texas well in which the lower productive zone proved unprofitable. The operator decided to come back up the hole and perforate a promising three foot zone at 2134 feet. At this interval 7" O.D. 24 lb. casing had been cemented in open hole. A string of 5½" O.D. 14 lb. casing had been cemented in the 7" and inside the 5½" was a 4½" O.D. liner.

Eighteen improved ½" Ogival Bullets were fired in the three foot zone by 3⅜" O.D. McCullough M-3 Bullet Perforators. Two perforating runs were made with a bailer run in between. Total time on the job, including the bailer run was two hours. Result: A fine well for the field and another satisfied McCullough customer.



Three string penetration is seldom necessary, yet it is assuring to know that McCullough M-3 Bullet Guns have the firing power needed to accomplish such a job. Even more assuring is the knowledge that, for the usual single string perforating, M-3 Guns will give you depth of penetration that cannot be equalled by any other bullet perforator.

Deep penetration is the most important single benefit to be gained from perforating. M-3 Bullet Guns have the power to penetrate one, two, or even three strings of tough casing (as in the above job); through cement sheaths and deep into the formation—far enough out into the pay zone to get the results you want—peak production, more oil!

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ROCK-BIT DESIGN, SELECTION, AND EVALUATION—8

Different Cutting Jobs Affect Bit Design

by H. G. Bentson

IN the foregoing installments only those basic fundamentals of rock-bit design which are common to all types have been considered. Factors which govern basic-cone or cutter configuration and various design criteria apply regardless of whether the type under consideration is for a soft or a hard formation.

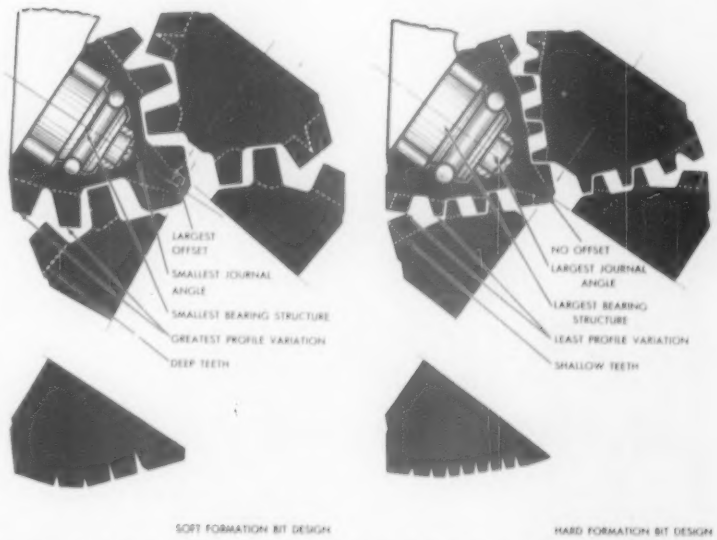
The design of a bit for use in certain types of formations obviously requires the application of additional design factors. For example, journal angle and offset values, rolling characteristics of the cones, and the effect of tooth depth on bearing structure size, represent several of the factors which must be considered in the cone-bit design.

The application of these design factors is shown in Fig. 16. Since the greatest variation in each of the factors exists between the soft and hard-formation bits, three-cone design layouts for each of these types of bits are presented.

Needed action . . . The action of the cones on the formation is of prime importance in regard to the ability of a bit to drill with a desirable penetration rate. A soft-formation bit requires a gouging-scraping action, whereas a hard-formation bit requires a chipping-crushing action.

Basically, these actions are governed by the degree to which the cones approach that of a true roll. A maximum gouging-scraping action requires rolling characteristics which vary the greatest from that of a true roll. A chipping-crushing action requires that which more nearly approaches that of a true roll.

Author is chief sales engineer, H. C. Smith Tool Co., Compton, Calif.



COMPARISON of three-cone bit designs for soft and hard formations. Fig. 16.

How designed . . . Factors in the design which produce these desirable characteristics are: degree of journal angle, amount of offset, and profile of the cone. A combination of the smallest journal angle, largest offset angle, and greatest variation in cone profile angles will develop an action which varies the most from that of a true roll.

Conversely, a combination of the largest journal angle, no offset, and least variation in the cone profile will result in an action which closely approaches that of a true roll.

The effect of tooth depth on bearing structure size is illustrated also by Fig. 16. Since the requirements for a soft-formation bit dictate the use of deep teeth, it is obvious that a sacrifice in bearing structure size must result. The condition is reversed, however, for the hard-formation bit.

Inasmuch as the tooth depth requirements are much less for this type of bit, the size of the bearing structure can be increased considerably. Although it is not shown in the illustration, the effect of tooth depth on bearing size obviously would apply to the cross-section bit as well.

Because of the difference in bit geometry, most of the design factors for the cone and cross section designs have been dealt with separately in the previous installments. Additional factors, such as tooth design and hardfacing patterns, however, can be discussed jointly since they apply basically to both designs. Part 9 will deal with these factors in the next installment.

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Reed Places Sixth Rig In Oklahoma Operation

Reed Drilling Co., Tulsa, recently placed in operation its sixth rotary rig. It is a 4,500-ft. unit, acquired from Shenandoah Drilling Co., and currently is working in Seminole on contract. It includes a National T12 draw works, a 14-in. Oilwell pump, and a Lee C. Moore mast. The company operates primarily in Oklahoma, and now has rigs in Tulsa, Seminole, Noble, and Grant counties. R. B. Reed is president; R. J. LaFortune, vice president and secretary; and R. R. Lockwood, Jr., treasurer.

Graham-Michaelis Drilling Co. has a rig under contract to Champlin Refining Co. on a Mississippian exploratory test inside the Hugoton gas area in Haskell County, western Kansas. The test, now nearing its objective, is 13 miles north of Sublette, at 1 Thompson, in 21-27-32.

Bryant-Hayward Drilling Co., Oklahoma City, is drilling for Shell Oil Co. on a newly started test 1½ miles northwest of Northeast Laverne pool, in southwestern Harper County, northwestern Oklahoma. Location is on a state lease in 34-27n-25w. Plans call for a 7,100-ft. test.

Great Western Drilling Co., Midland, Tex., has taken a contract for a deep test at a remote wildcat location in northeastern Castro County, in the southwestern part of Texas' Panhandle district. It will be drilled for I. A. Stephens and others at 1 Little, in Section 172, Block M-6, Stone, Kyle & Kyle Survey. Location is 20 miles northeast of Dimmit, and about 50 miles from nearest production. It will be a Pennsylvanian reef test to about 8,200 ft.

Johnson Drilling Co., Tyler, has a rig working for E. A. Ellison and others at a wildcat location, 1 Grissom, in the Jacob Lewis Survey, 2 miles southwest of Troup, in Cherokee County, East Texas. Location is 3½ miles northeast of North Jacksonville field. It is a 4,300-ft. Woodbine test.

Nowery Drilling Co., Shreveport, has a new contract operation under way in Ada field, Bienville Parish, North Louisiana. It is a 7,800-ft. Lower Cretaceous - Hosston well for Southwest Natural Production Co. Designation is 1 White, in 32-18n-7w.

Falcon Seaboard Drilling Co., Tulsa, has a new wildcat operation scheduled for northern Vermilion Parish, Louisiana Gulf Coast. It is a contract job for Buffalo Oil Co. at 1 Manes, in 6-11s-3e. Location is 2½ miles southwest of production in the Ridge-Duson area.

George W. Reed, (center), president, with Walter McKenzie (left), vice president, and William Berard (right), treasurer, of the recently formed Ace-Hi Drilling Co., of Tulsa. They supervise the contract operations of 17 small rotary-type rigs engaged in all phases of shallow exploratory drilling.

Reed, formerly vice president of Exploration Consultants, Inc., and a graduate of Colorado School of Mines, has had more than 20 years of experience in oil exploration work. McKenzie has been an independent shot-hole contractor for several years.

John Carlson (not shown), a Tulsa attorney, is secretary of the company.

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in southwestern Lafayette Parish, and about 4 miles north of the Abbeville north extension area, of Vermilion Parish. Plans call for a 12,500-ft. test.

Rush Drilling Co., Houston, is contractor on the new wildcat test Robert Mosbacher and others are starting at 2 Rice Land, in 28-4s-11w, 3 miles northwest of Juanita production, in Beauregard Parish, southwestern Louisiana. It is a 7,900-ft. operation.

Harkins Drilling Co. is contractor on a projected 9,000-ft. test C. M. & W. Drilling Co. and British Texan Oil, Ltd., are starting 5 miles southeast of Gonzales, in Gonzales County, Southwest Texas. Location is on the operators' Tenberg lease, in the N. Osborne Survey.

Woolf & Magee, of Tyler, Tex., will drill a Smackover test for Southwest Gas Producing Co., of Monroe, La., at a wildcat location 2 miles north of Mer Rouge, in Morehouse Parish, northeastern Louisiana. Location is at 1 Barham, in 12-21n-6e, is about 8 miles east of Monroe gas field. Nearest other production is 9 miles southeast in Beckman field. A depth of at least 6,600 ft. is expected.

Glen Drilling Co., Shreveport, has a contract for a 7,000-ft. Pettet test to be drilled for Apache Oil Corp., of Tulsa, about 4 miles northeast of Bethany-Longstreet field, in DeSoto Parish, Northwest Louisiana. Location is for 1 Townsend Unit, in 2-14n-15w, about 3 miles northeast of Keatchie.

Eagle Drilling & Development Co., Natchez, Miss., is moving to a wildcat location a mile south of New Era field, 10 miles south of Natchez, in western Adams County, southwestern Mississippi, where it will drill a 6,900-ft. Wilcox test for Norman Germany and G. W. Gulmon. Location is listed as 1-B Pierce Butler, spotted in 9-5n-3w.

Wilson Drilling Co., Jackson, Miss., is on a new contract job in Adams County, southwestern Mississippi. It is a 6,000-ft. Wilcox test for John S. Callon, of Natchez, at 1 Marshall, in 38-7n-2w. Location is a mile east of Homewood field, southeast of Natchez.

Tri-Service Drilling Co. has a deep contract job working about 3 miles east of Echol field, in eastern Lea County, New Mexico. It is for Texas Crude Oil Co. at 1-3 Argo-State, in 3-14-38. Plans call for a 12,500-ft. test. Location also is about 5 miles south of the Bronco area, on the Texas-New Mexico line.

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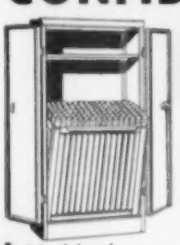

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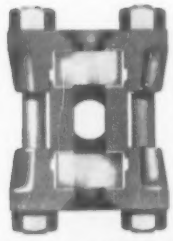

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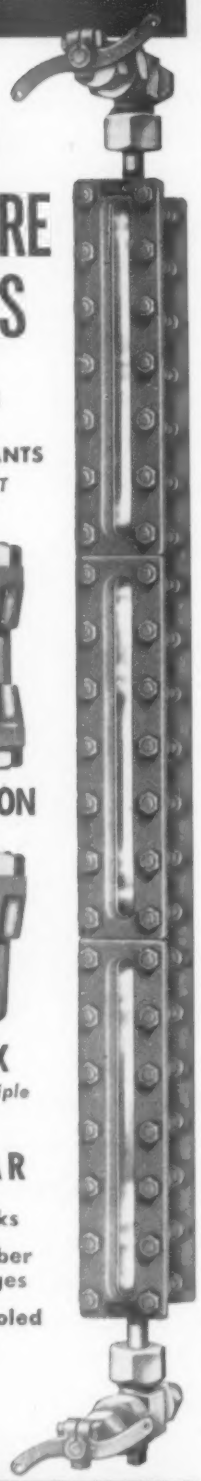

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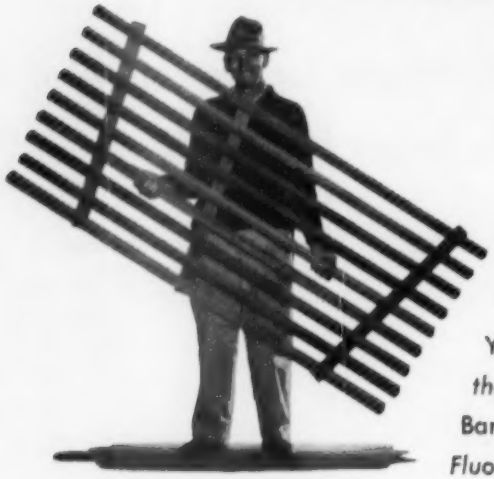

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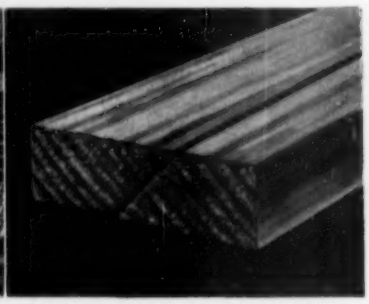

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Pipeline Patrol

. . . Report on Construction

Under Way, Contracted, and Planned

PIPELINE activity reported here is compiled from surveys conducted by The Oil and Gas Journal among pipeline companies and contracting firms. Projects listed include those proposed, contracted, and under way. Uncontracted projects are indicated by • preceding the project.

Crude-Oil Pipelines

Fulton, R. H. & Co., Lubbock, Tex.
Project: 20 miles of 6-in. from Donkey Creek field near Moorcroft, Wyo., to Butte Pipe Line Co.'s line.
Status: Fulton, a contractor, has applied to Wyoming Public Service Commission. Application competes with that of Powder River Pipeline Co.

• **Humble Pipe Line Co.**
Project: 94 miles of 18-in. from Ector County to Kemper County, Texas.
Completion: February 1, 1957.

• **Interstate Oil Pipe Line Co.**
Project: 5 miles of 4-in. from South Bosco field, Louisiana, to present main line, and 5 miles of various size from Church Point field, Louisiana, to present main line.
Status: Proposed.
Project: 5 miles of 8-in. from McKamie Station to Magnolia Station, Arkansas.
Status: Under way.
Contractor: **J. C. Moore Construction Co.**
Project: 16 miles of 12-in. from Pelican Island to Lake Washington, Louisiana.
Status: Under way.
Contractor: **Glaser Construction Co., Inc.**
Completion: November 20, 1956.

• **Northwest Pipeline Corp.** (an affiliate of Pacific Northwest Pipeline Corp.)
Project: 80 miles of 8-in and 300 miles of 10-in. crude and products line from Four Corners area to Salt Lake City.
Completion: August 1957.

• **Offshore Gathering Corp.,** Houston.
Project: 364 miles of mostly 20-in. in Gulf of Mexico off Louisiana.
Status: Proposed.

Ohio Oil Co.
Project: 504 miles of 8-in. from Teutopolis, Ill., to Spitzmesser, Ind.
Contractor: **O. R. Burden Construction Corp.,** F. W. Lewis, spread superintendent with office at Sheridan, Ind.; P. E. Thibodaux, spread superintendent with office at Rockville, Ind.

• **Pasotex Pipe Line Co.**
Project: 127 miles of 20-in. along its route from Wink to El Paso, retiring another dual 8-in. section.
Status: Planned.
Completion: July 31, 1957.

• **Powder River Pipeline Co.,** Fratt Building, Billings, Mont.
Project: 20 miles of 6-in. from Donkey Creek field near Moorcroft, Wyo., to Butte Pipe Line Co.'s line. (See Fulton, R. H. & Co., above.)
Status: Planned.

• **Service Pipeline Co.**
Project: 30 miles of 3, 4, 6-in. to connect 16 new leases in Antelope, Charlson, Sanish, and Blue Buttes pool in McKenzie County, North Dakota, to its present gathering system.
Status: Planned .
Project: 5 miles of 12-in. near El Dorado, Ark.
Contractor: **O. R. Burden Construction Corp.,** R. M. Jones, spread superintendent, office at El Dorado.

• **Shannon Oil Co.,** Denver.
Project: 34 miles of 6-in. from Murphy dome in Hot Springs County, Wyoming, to contact Ohio Oil Co.'s line in Big Horn County. Joint project with Farmers Union Central Exchange, Inc., and Mule Creek Oil Co., both of Billings, Mont.
Status: Under way.
Completion: December 1, 1956.

Shell Pipe Line Corp.
Project: 42 miles of 20-in. from Shell's Houston refinery to Brookshire Station.
Status: Under way.
Contractor: **Bill Murry & Co.;** Bill Murry spread superintendent, office 12629 South Main Street, Houston.
Completion: December 1, 1956.

• **Sinclair Pipeline Co.**
Project: 150 miles of 20-in. from Teague, Tex., to Houston.
Status: Planned.
Completion: 1957.

• **Tecumseh Pipe Line System**
Project: 190 miles of 20-in. between Griffith, Ind., and Cygnet, Ohio. Joint project with Sinclair Refining Co., Pure Oil Co., Ashland Oil & Refining Co.
Status: Awaiting pipe.
Completion: September 1957.

• **Union Oil Co. of California.**
Project: 225 miles of 16-in. from San Joaquin Valley to its refinery at Oleum, Calif.
Status: To start December 1, 1956.
Completion: Late 1957.

Products Pipelines

• **American Pipe Line Co.**
Project: Line from Gulf Coast to New York City area. Received ODM approval to amortize 40 per cent of $175,000,000 cost with a rapid writeoff.
Status: Planned.

• **El Paso Natural Gas Co.**
Project: 11 miles of 4-in. L.P.G. products from Snyder Line to South Andrews Plant, Texas.
Status: Planned.

• **Gulf Refining Co.**
Project: 45 miles of 8-in. from Pontiac Eastern Corp.'s planned refinery at Hattiesburg, Miss., (due on stream May 1957) to a connection with Plantation Pipe Line Co.'s system.

• **Northwest Pipeline Corp.** (an affiliate of Pacific Northwest Pipeline Corp.)
Project: 80 miles of 8-in. and 300 miles of 10-in. products and crude line from Four Corners area to Salt Lake City.
Status: To start May 1957.
Completion: August 1957.

Phillips Petroleum Co.
Project: 66 miles of 12-in. from Borger, Tex., to Cassoday, Kan.
Status: Work started late October 1956.
Contractor: **Vedal Construction Co.**

• **Phillips Pipe Line Co.**
Project: 135 miles of 12-in. looping between Borger, Tex., and St. Louis.
Completion: December 31, 1956.

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"Two of the 1956 Ford BIG JOBS in our fleet . . . Ford C-900 tanker (left), Ford F-900 tractor (right)."

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Pipeline Patrol

Plantation Pipe Line Co.
Project: 327 miles of 18-in. from Baton Rouge, La., to Helena, Ala.
Status: Under way.
Contractor: **Oklahoma Pipe Line Constructors;** N. L. Arie, spread man, office at Baton Rouge.
Completion, December 1956.

Shell Oil Co., Pipe Line Dept.
Project: 16 miles of 4-in. gasoline line from Wilmington, Calif., refinery to Los Angeles marketing depot.
Status: Under way.
Contractor: **Ledford Brothers.**
Completion: January 1, 1957.

Standard Oil Co. (Ohio)
Project: 37 miles of 8-in. from Mogadore to Girard, Ohio.
Status: Under way.
Contractor: **Somerville Construction Co.**
Completion: November 24, 1956.

- **Pure Transportation Co.**
Project: 8 miles of 10-in. from Smiths Bluff to Port Arthur Station of Evangeline Pipe Line System.
Status: To start December 1, 1956.
Completion: January 15, 1957.
- **Sioux Oil Co.**
Project: 80 miles of 4-in. from its Newcastle, Wyo., refinery to Rapid City, S. D.
Status: Planned.
Completion: Late 1956.
- **Southern Pacific Pipe Lines, Inc.**
Project: 300 miles of 6, 8, 10-in. to span the Sierras and connect San Francisco with Reno and Fallon, Nev., and to serve the Sacramento Valley.
Status: Planned.
Completion: August 1, 1957.
- **Union Oil Co. of California**
Project: 815-mile line from Rifle, Colo., to Los Angeles refining area, to carry products from its proposed Rifle shale-oil plant.
Status: Proposed.

Non-Petroleum Pipelines

American Gilsonite Co.
Project: 70 miles of 6-in. from Bonanza, Utah, to Grand Junction, Colo., to carry slurry of gilsonite from mines to refinery now being built.
Status: Under way.
Contractor: **Engineers Limited Pipe Line Co.**
Completion: Late 1956.

Dow Chemical Co.
Project: 16 miles of 4-8-in. brine lines.
Contractor: **Shamrock Construction Co.**
Completion: December 1956.

Natural-Gas Pipelines

- **Arkansas Louisiana Gas Co.**
Project: Line from Texas-Louisiana coastal region to northern Louisiana, to connect with their present system.
Status: Long-range plans.
- **Carolina Pipeline Co.**
Project: Distribution lines to serve 14 cities in Central South Carolina. Will buy gas from Transcontinental Gas Pipeline Co. or Southern Natural Gas Co.
Status: Has received South Carolina Public Service Commission permit.

Cities Service Gas Co.
Project: 9 miles of 16-in. and 4 miles of 8-in. near Springfield, Mo.
Status: Approved.
Contractor: **Prairie Construction Co.**
Completion: November 30, 1956.

- **Cities Service Pipe Line Co.**
Project: 27 miles of 6-in. from Lake Charles, La., to Orange, Tex.
Status: Planned.
Completion: April 30, 1957.
- **Coastal Transmission Corp.**
Project: 565 miles of 26-in. from McAllen, Tex., to Baton Rouge, to deliver to Houston Texas Gas & Oil Corp.'s proposed line to Florida. Also 272 miles of smaller gathering lines.
Status: Seeks FPC permit.
- **Colonial Natural Gas Corp.**
Project: Two systems; one between Houston-Lake Charles area and Miami, Fla.; one in the Carolinas and Georgia.
Status: Proposed.
- **Colorado Interstate Gas Co.**
Project: 238 miles of 22-in. from Laramie to Green River, Wyo. (last part of a 374-mile line between Denver and Rock Springs).
Status: Under way.
Contractor: **R. H. Fulton.**
Completion: January 1957.
Project: 26 miles of 8-in. loops at Cannon City, Colo.
Status: Planned.
Completion: December 1, 1956.

Write for Bulletin
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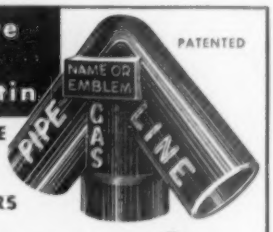

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Pipeline Patrol

Project: 1957 program . . . 66 miles of 30-in., 40 miles of 34-in., 109 miles of 26-in., and 100 miles of 24-in. from Springfield, Colo., to Pueblo, Colo; 345 miles of 30-in. from Kit Carson, Colo., to Beatrice, Neb.; 50 miles of 22-in. from Laverne to Hooker, Okla.; 24 miles of 22-in. Panhandle field looping.

Status: Pending FPC approval.

Commonwealth Natural Gas Corp.

Project: 40 miles of 18-in. looping from Gum Springs to Chester, Va.

Status: Under way.

Contractor: **Pipeline Maintenance & Construction Co.**

Completion: January 15, 1957.

• **El Paso Natural Gas Co.**

Project: 193 miles of 34-in. between San Juan basin and Topock, Ariz., and 38 miles of 20-in. between San Juan mainline and Phoenix.

Status: Under way.

Contractor: Doing own construction.

Completion: February 1, 1957.

Project: 146 miles of 34-in. between San Juan basin and Topock.

Contractor: **Western Pipeline, Inc.**

Completion: February 1, 1957.

Project: 149 miles of 20-in. between San Juan mainline and Phoenix.

Status: Under way.

Contractor: **Western Pipeline, Inc.**

Completion: December 1, 1956.

Project: 29 miles of 30-in. from Lindrith Station to Chaco Plant, New Mexico.

Status: Planned.

Project: 29 miles of 18-in. from Panoma Plant to Dumas Plant, Texas.

Status: Planned.

Project: 84 miles of 34-in. looping on San Juan main line and 21 miles of 30-in. looping on Permian-San Juan line.

Status: Planned.

Completion: June 30, 1957.

Project: 23 miles of 20-in. from South Andrews Station to Shell's TXL Plant, Texas.

Status: Planned.

Project: 9 miles of 16-in. from Shell's TXL Plant to Goldsmith Plant, Texas.

Status: Planned.

Project: 8 miles of 26-in. Southern System second loop west of Gila Station, Arizona.

Status: Planned.

Project: 28 miles of 10-in. in Nolan and Coke counties, Texas.

Status: Under way.

Contractor: **McVean & Barlow.**

Completion: January 1, 1957.

Fish-Service & Management Corp. (Agent for Cascade Gas Co.)

Project: City distribution system—205 miles of 1 to 8-in. in Washington and Oregon.

Status: Under way.

Contractor: **Ted Price Construction Co.,** Electric, Tex. Three spreads—M. E. Pulliam, spread superintendent, office at Walla Walla, Wash.; K. D. Garrett, spread superintendent, office at Pendleton, Ore.; E. E. Hanks, spread superintendent, office at Baker, Ore.

Completion: 1957.

Hope Natural Gas Co.

Project: 22 miles of 8-in. in Logan County, West Virginia, and 20 miles of 3 to 8-in. in various West Virginia counties.

Status: Under way.

Contractor: **R & M Pipelines, Inc.,** Charleston, W. Va.

Completion: Late 1956.

• **Houston Texas Gas & Oil Corp.**

Project: 960 miles of 26-in. between Baton Rouge, La., and Miami, Fla., plus 500 miles of sales laterals in Florida, with main line joining Coastal Transmission's proposed line from McAllen, Tex., to Baton Rouge.

Status: Pending FPC approval.

• **Iron Ranges Natural Gas Co.,** St. Paul.

Project: 68-mile transmission line and 47 miles of laterals to supply towns on the Mesabi Iron Range, Minn.

Status: Application pending with FPC.

• **Kansas-Nebraska Natural Gas Co., Inc.**

Project: 10 miles of 10-in. and 10 miles of 8-in. from Grand Island to Albion, Neb.

Status: Planned.

Completion: November 1956.

Project: 27 miles of 12-in. from Camrick field to Liberal, Kans.

Status: Pending FPC approval.

Completion: November 1956.

Project: 11 miles of 12-in. from Scott City to Oakley, Kans., to replace equal quantity of 8-in.

Status: Has FPC permit.

Completion: December 1956.

• **Lone Star Gas Co.**

Project: 230-mile line from Cotton County, Oklahoma, to Fritch, Tex., and a 205-mile line from Snyder, Tex., to hook up with the Cotton-Fritch line. Being contested by Natural Gas Pipeline Co. of America.

Status: Application pending with FPC.

Michigan Consolidated Gas Co.

Project: 67 miles of 10 and 12-in. between Sears and Travers City, Mich.

Status: Under way.

Contractor: **Somerville Construction Co.;** Floyd Huduall, spread superintendent, office at Cadillac, Mich.

Project: 60 miles of 10 and 12-in. between Muskegon and Ludington, Mich.

Status: Under way.

Contractor: **Somerville Construction Co.,** jointly with **J. L. Gentry Construction;** Frank

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Pipeline Patrol

Morris, spread superintendent, office at Hart, Mich.

• **Michigan Wisconsin Pipe Line Co.**

Project: 142 miles of loops in Wisconsin and Illinois.

Status: Under way.

Contractors: **H. C. Price Co. and Houston Contracting Co.** Price will build 56 miles of 24-in., and Houston will build 42 miles of 20-in. and 51 miles of 16-in. (being handled by Latex Construction Co. of Georgia), spread office at Fond du Lac, Wis.

Project: 40 miles of 6, 4-in. looping in Wisconsin.

Status: Under way.

Contractor: **G. E. T. Construction Co.**

Completion: November 1956.

Project: 47 miles of 6, 4-in. looping in Iowa and Missouri.

Status: Under way.

Contractor: **Gabe's Construction Co.**

Completion: November 1956.

Project: 31 miles of 6, 4-in. new and loop lines in Michigan and Indiana, and 24 miles of 24-in. looping in Wisconsin.

Status: Has FPC permit.

Completion: 1957.

• **Midwestern Gas Transmission Co.**

Project: Will build main line from Portland, Tenn., to Canadian border near Emerson, Man.; 829 miles of 24-in., 109 miles of 16-in., 174 miles of 12-in., 648 miles of 3 to 18-in. extensions in Minnesota and Wisconsin.

Status: Application pending with FPC.

Montana-Dakota Utilities Co.

Project: 28 miles of 12-in. from Fallon County to Dawson County, Montana.

Status: Under way.

Contractor: **Ross Powers Construction Co.**, Billings, Mont.

Montana Power Co.

Project: 75 miles of 6-in. from Big Coulee field to Lewiston and Harlowton, Mont.

Status: Under way.

Contractor: **O'Connor Construction Co.**, Fromberg, Mont.

Completion: November 15, 1956.

• **Mountain Fuel Supply Co.**, Salt Lake City.

Project: 38 miles of line to connect with Pacific Northwest Pipeline Corp.'s system in Sweetwater County, Wyoming.

Status: Has temporary FPC permit.

• **Natural Gas Pipeline Co. of America**

Project: 350 miles of 20 and 26-in. from Jack and Wise counties, Texas, to Fritch, Tex., which is being contested by Lone Star Gas Co.

Status: Has FPC approval.

Project: 389 miles of 36-in. loops along its line from Beatrice, Neb., to Chicago, to take gas from proposed line of Colorado Interstate Gas Co., and for 91 miles of 30-in. loops along parts of its main line.

Status: Application pending with FPC.

Niagara Mohawk Power Corp.

Project: 272 miles of 2 to 12-in. distribution mains for growth of service area in central, eastern, and northern New York.

Status: Fifty per cent completed.

Contractors: Various.

Completion: December 31, 1956.

• **North Carolina Natural Gas Corp.** (Subsidary of Colonial Natural Gas Corp.)

Project: 575 miles of 3 to 16-in. from Transcontinental Gas Pipe Line Corp.'s system near Mooresville, eastwardly across north Carolina.

Status: Has permit from North Carolina Utilities Commission.

• **Northern Natural Gas Co.**

Project: 11 miles of 16-in., 81 miles of 12-in., 71 miles of 10-in. from Sioux Falls, S. D., to Aberdeen, S. D.

Status: Under way.

Contractor: **R. H. Fulton & Co.**

Project: 160 miles of 2, 3, 6, 8-in. branch lines to serve 20 new communities on Aberdeen, S. D., line.

Status: Under way.

Contractor: **Troth Construction Co.**

Project: 15 miles of 24-in. looping north and south of Hooper, Neb.

Status: Under way.

Contractor: **R. H. Fulton & Co.**

Project: 8 miles of various size branch lines to serve 8 new communities in Iowa.

Status: Under way.

Contractor: **Underground Constructors, Inc.**

Project: 73 miles of 20-in. from Savana Creek to Pincher Creek fields in Alberta, Canada; 32 miles of 24-in. from Pincher Creek to Montana border; 1,100 miles of 26-in. from Montana into Minneapolis.

Status: Planned.

• **Offshore Gathering Corp.**, Houston.

Project: 364 miles in Gulf of Mexico off Louisiana.; 60 miles of 24-in., 70 miles of 26-in., 234 miles of 30-in.

Status: Application pending with FPC.

• **Ohio Fuel Gas Co.**

Project: 19 miles of 5, 12, 16-in. to replace or loop present facilities serving Dayton and Toledo areas, and extend service to McCutchenville.

Status: Pending FPC approval.

• **Pacific Gas & Electric Co.**

Project: 37 miles of 20-in., 37 miles of 18-in. 9 miles of 12-in. from Beehive Bend field near Willows, Calif., to near Davis, then to Sacramento.

Status: Planned.

Project: 135 miles of 34-in. looping of the Topock-Milpitas line.

Status: Under way.

Contractor: A joint-venture firm, **Midwestern-Johnson-Dixon**, has 85 miles to complete this year.

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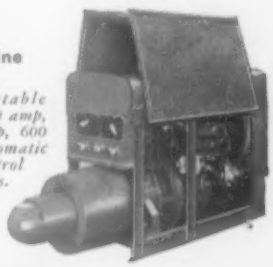

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Pipeline Patrol

Completion: Major part to be laid in 1956; 62 miles in 1957.

Project: 200 miles of 12-in. from Sacramento Valley gas fields to Humboldt County, California.

Status: Has filed for approval of California's Public Utilities Commission. To start early 1957.

Completion: December 1, 1957.

• **Pacific Northwest Pipeline Corp.**

Project: 37 miles of 6-in. from Dove Creek to Nucla, Colo., and 13 miles of 4-in. from Nucla to Urvan, to serve Union Carbide Nuclear Co. and Vanadium Corp. of America.

Status: Has FPC permit.

Project: 156 miles of 20 and 16-in. laterals from main line to Spokane, and 129 miles of laterals into Idaho.

Status: Under way.

Contractor: **R. H. Fulton & Co.**

Completion: Fall 1956.

• **Panhandle Eastern Pipe Line Co.**

Project: 82 miles of 4 to 12-in. gathering lines.

Status: Proposed. Bids have been requested.

Completion: December 31, 1956.

• **Peoples Natural Gas Co.**

Project: 4 miles of 12-in. from Evans City to Harmony, Pa.

Status: Planned. FPC permit not required.

Completion: January 1, 1957.

Permian Basin Pipeline Co.

Project: 19 miles of 16-in. in Andrews County, Texas.

Contractor: **R. H. Fulton & Co.**

• **Phillips Petroleum Co.**

Project: 14 miles of 2 to 10-in. in Carson County, Texas.

Completion: December 1, 1956.

Project: 54 miles of 2 to 10-in. in Hutchinson County, Texas.

Completion: January 1, 1957.

• **Piedmont Gas Co.,** Hickory, N. C. (Parent is Carolina Natural Gas Corp.)

Project: 78 miles of 2 to 8-in. extension off Trancontinental in North Carolina to serve Gaston, Lincoln, Catawba, Caldwell, and Burke counties.

Status: Application pending with FPC.

Southern California Gas Co. and Southern Gas Co. of California

Project: 241 miles of 30-in. from the outskirts of Los Angeles to Topock on the Arizona-California border.

Status: Right-of-way and ditch under way; pipe laying begins in January, 1957.

Contractor: **R. H. Fulton & Co.**

Completion: June 30, 1957.

Project: 49 miles of 30-in. from Newhall to Alhambra, Calif.

Status: Under way.

Contractor: **Joe E. Young Contractors, Inc.,** has 19 miles from Encino to Newhall, Calif. **Macco Corp.** has 16 miles from Encino to Glendale, Calif. **Alex Robertson Co.** has 14 miles from Glendale to Alhambra, Calif.

Completion: December 1, 1956.

Spokane Natural Gas Co.

Project: 400 miles of 1 through 24-in. distribution system at Spokane.

Status: Under way.

Contractor: **Hallmac Construction Co.**; V. L. Williams, spread superintendent, office at Spokane.

Completion: 1957.

• **Tennessee Gas Transmission Co.**

Project: 221 miles of 30-in., 101 miles of 26-in., and 10 miles of 24-in. looping from Portland, Tenn., to Greenup, Ky.; from Morehead, Ky., to Catlettsburg, Ky.; from Catlettsburg to Broad Run, W. Va.; from New Wilmington, Pa., to Mercer, Pa.; and from New Castle, Pa., to near Pittsburgh, Pa.

Status: Pending FPC approval.

Project: 51 miles of 26-in., 51 miles of 20-in., and 17 miles of 12-in. gathering lines from Kinder, La., to offshore fields in Gulf of Mexico.

Status: Pending FPC approval.

Project: 577 miles of 30-in. from Mississippi River delta area south of New Orleans to Portland, Tenn.

Status: Pending FPC approval.

• **Texas Eastern Transmission Co.**

Project: 422 miles of 30-in. from near McAllen to Beaumont, Tex., to move imported Mexican gas; 45 miles of 24-in. laterals from McAllen to Provident City, Tex., 77 miles of 30-in. looping between Kosciusko, Miss., and Uniontown, Pa.; 147 miles of supply and sales laterals.

Staus: Has FPC approval to start immediately.

Contractor: **Houston Contracting Co.** has 121 miles of 30-in. between Angleton and Vidor, Tex., to start March 1, 1957.

Completion: Fall 1957.

Texas Gas Transmission Corp.

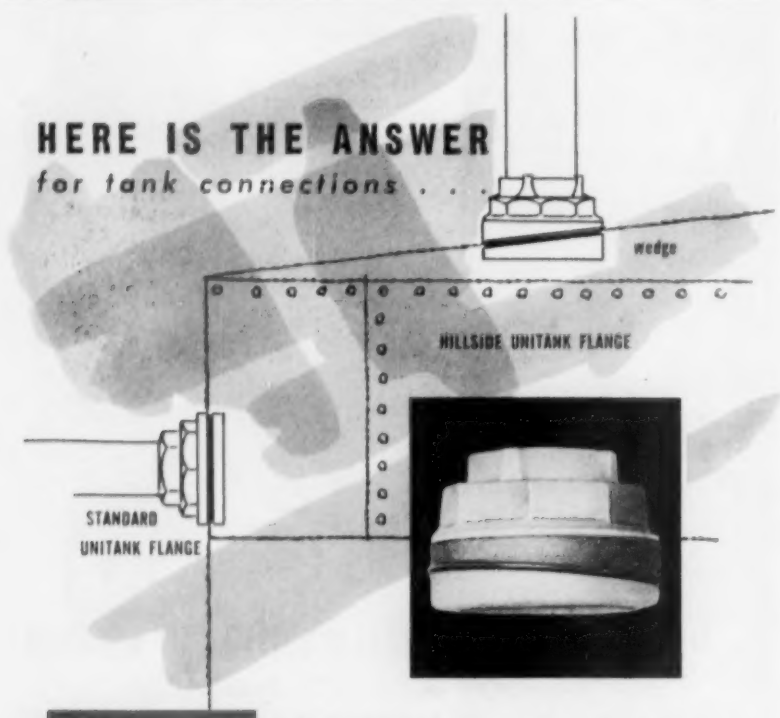
Project: 120 miles of 20-in. and 11 miles of 16-in. from near Eunice, La., east to near Thibodaux, La.

Status: Work started late October.

Contractor: **Houston Contracting Co.** Spreads: 11 miles of 16-in. and 50 miles of 20-in. from near Eunice to near New Iberia, F. A. Silar, spread superintendent, office at Crowley, La.; 45 miles of 20-in. from near New Iberia to near Morgan City, M. L. Thompson, sperad superintendent, office at Franklin; 25 miles of 20-in from near Morgan City to near Thibodaux, W. H. Hayes, superintendent, office at Thibodaux.

Completion: December 1956.

• **Trans Carolina Pipe Line Corp.,** Commercial Building, Raleigh, N. C.



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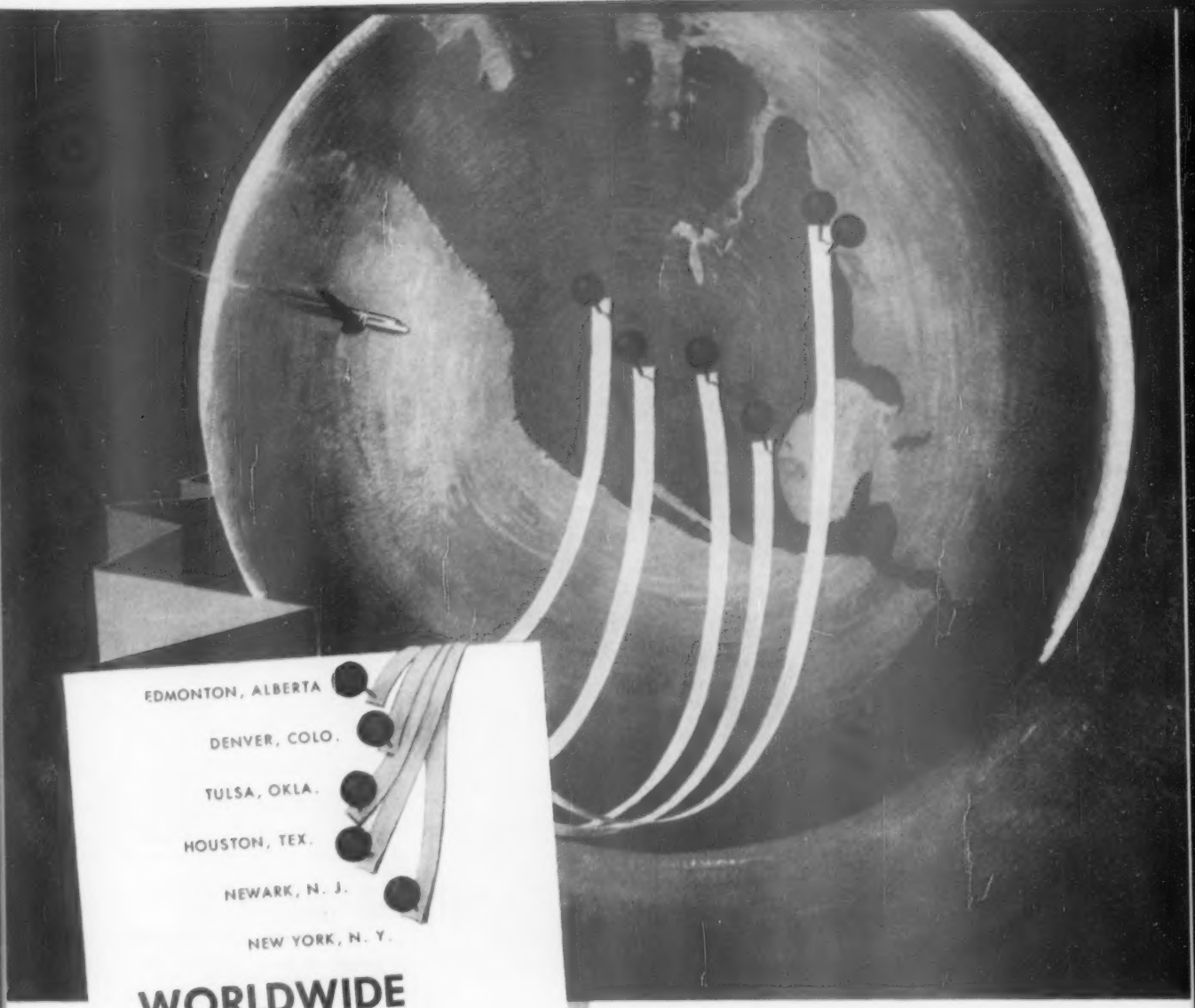

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CLEANING & PRIMING MACHINES

Pipeline Patrol

Project: 300-mile system across North and South Carolina, plus 500 miles of laterals.
Status: FPC approval pending

• **Transcontinental Gas Pipe Line Corp.**
Project: 160 miles of 36-in., 67 miles of 30-in., 24 miles of 24-in. loops from Louisiana to Pennsylvania.
Status: Pending FPC approval.
Completion: December 1, 1956.
Project: 25 miles of 36-in. loops from Louisiana to South Carolina, 31 miles of 36-in. and 43 miles of 30-in. line.
Satus: Pending FPC approval.

United Fuel Gas Co.
Project: 15 miles of 12-in. in Kanawa County, West Virginia.
Status: Under way.
Contractor: **Williams - Austin Co.**; O. L. Martin, spread superintendent, office at Charleston, W. Va.
Completion: November 1956.

Foreign Crude-Oil Pipelines

Arabian American Oil Co.
Project: 140 miles of 20-in. from Safaniya field to Ras Tanura, Saudi Arabia.
Status: Under way.

B-A Alberta Pipe Line, Ltd.
Project: 35 miles of 8-in. to connect Drumhell field, Alberta, with existing lines running to Edmonton.
Status: Pending approval.

Interprovincial Pipe Line Co.
Project: 151 miles of 20-in. to extend present line from Sarnia to Port Credit, Ont.
Status: Pending approval of Board of Transport Commissioners. If approved, work will start spring 1957, end that fall.

• **Mene Grande Oil Co.**
Project: 11 miles of 6-in. from Elias to Fria, and 10 miles of 10-in. from Limon to Leona-Dacion lateral, Venezuela.
Completion: First quarter 1957.
Project: 24 miles of 12, 14, 16-in. from Oficina Tank Farm to Oveja.
Completion: Late 1956.

Pembina Pipe Line, Ltd.
Project: 100 miles of 3 to 10-in. gathering system in Pembina field.
Contractor: **Sparling Davis Co., Ltd.**
Project: 200 miles of 3 to 12-in. gathering line in Pembina oil field.
Contractor: **Mannix, Ltd.**; F. Whitlow, spread superintendent, office at Pembina oil field.

• **Royal Dutch-Shell**
Project: 700-mile line across Europe from the Mediterranean to the North Sea, running through Eastern France, Luxembourg, West Germany, and Netherlands, and Belgium. Main trunk to be 30-in.
Status: Company is considering project together with several other companies.

• **Sinclair Oil Corp. and Socony Mobil Oil Co.**
Project: 211 miles of 20-in. from the Silvestre field in Barinas, Venezuela, to Puerto Cabello on Caribbean Sea.
Status: Under way.

Union of Soviet Socialist Republic
Project: 2,300-mile Trans-Siberian crude and products line from Ufa and the Tuimaza fields in Bashkiria to Irkutsk near Lake Baikal.
Status: Under way.

Yacimientos Petroliferos Fiscales (Argentina)
Project: 700 miles of 12-in. from Campo Duran to San Lorenzo.
Status: Under way.
Contractor: **TECHINT** (Compania Tecnica Internacional), Buenos Aires, has 90 miles.

Yacimientos Petroliferos Fiscales Bolivians (Y.P.F.B.)
Project: 160 miles of 10-in. and 43 miles of 8-in. from Sicascia to Arica on the Chilean coast.
Contractor: **Williams Brothers Co.**
Completion: December 1957.

Foreign Products Pipelines

• **Estrada de Ferro Santos a Jundial Departamento Oleducto**
Project: 6 miles of 14-in. from Capauva refinery to Utinga Terminal.
Status: Planned.
Completion: December 1956.

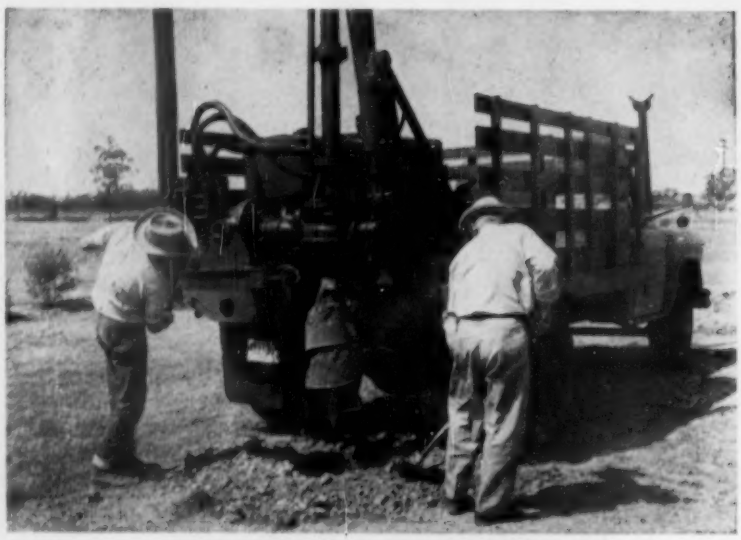
Hydrocarbons Pipeline Co. (Subsidiary of Canadian Hydrocarbons)
Project: 800 miles of 6 and 8-in. L.P.G. line from near Edmonton, Alta., to Fort William, Ont.
Status: Has permit from Parliament of Canada. If approved by Federal Board of Transport Commissioners and the Alberta Petroleum and Natural Gas Conservation Board, work will start early 1957.
Construction consultants: **Dutton-Williams Brothers, Ltd.**, Calgary, and **A. D. Little & Co.**, Boston.

• **Iraq Petroleum Co., Ltd.**
Project: 75 miles of 24-in. from Homs, Syria, to Tripoli, Lebanon.

Israeli Government
Project: A 6-in. line from the Haifa refinery to Tel Aviv.
Completion: Late 1957.

National Iranian Oil Co.
Project: 573 miles of 10-in. from Ahwaz to Teheran, Iran.
Contractor: **Enterpose of Paris**, has northern 236 miles. Southern section completed.

• **North Atlantic Treaty Organization (NATO)**
Project: 2,000 miles of lines to airfields in parts of Europe.
Status: Under way.
Contractors: **Associated Pipeline Contractors, Inc.**, has 450 miles from Iskenderun,



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This company asked for competitive bids on protecting 350 miles of bare pipeline that ran across three states. CSI was awarded the turnkey installation contract.

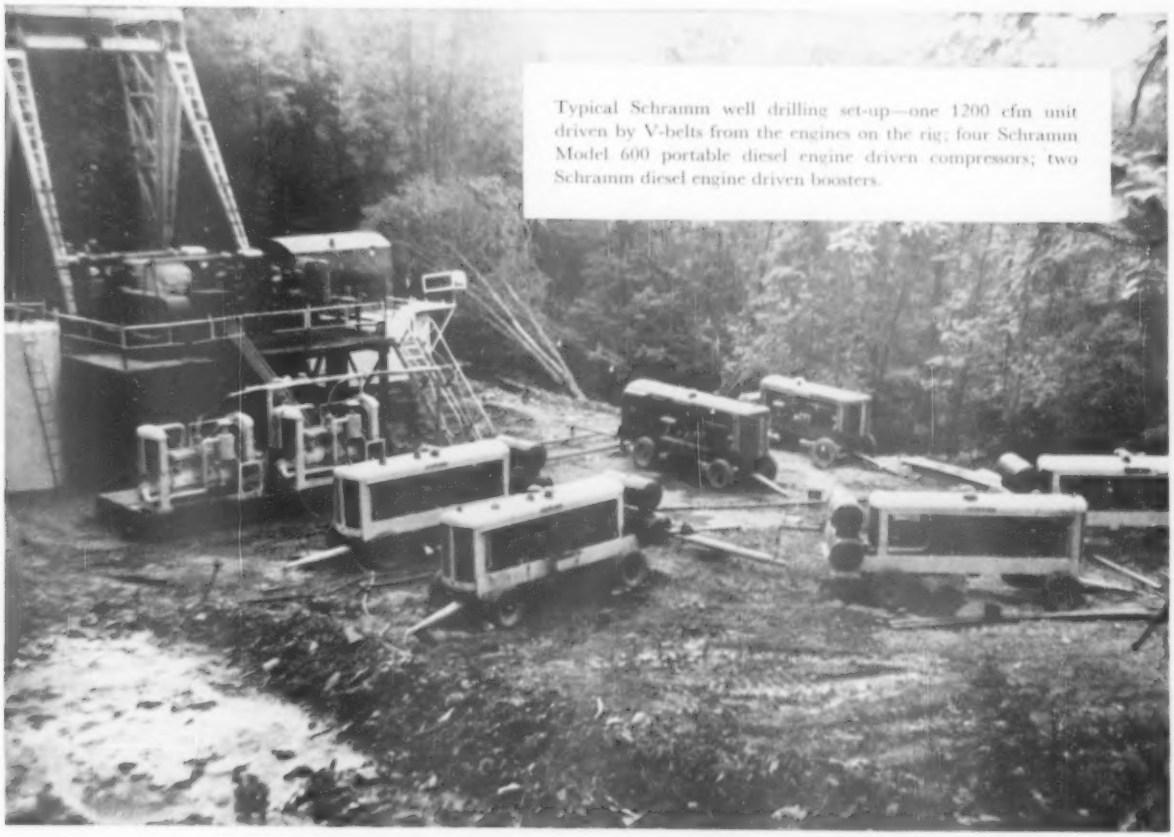
- Only Galvomags, Dow's high-potential magnesium anodes, were used. Several thousand of these anodes were furnished by CSI.
- All chaining, pipe locating and installation was done by CSI.
- Care was taken to hold crop and surface damage to a minimum. In towns, sod was carefully replaced.
- Power-augering equipment and ditching machines were furnished by CSI.

It will pay you to get the CSI story. Stockholder-employees, experienced engineers and trained crews are your assurance of a quality installation job.

Call or write today. Ask also about CSI's engineering services and complete line of name-brand cathodic protection materials.

CSI
CORROSION SERVICES INCORPORATED
Tulsa, Oklahoma

P. O. Box 7343, Dept. 27 Telephone: Circle 5-1351



Typical Schramm well drilling set-up—one 1200 cfm unit driven by V-belts from the engines on the rig; four Schramm Model 600 portable diesel engine driven compressors; two Schramm diesel engine driven boosters.

Portable booster system...flexible as you wish

Gives any volume of air up to 1800 cfm at pressures up to 500 psi

When you need compressed air at higher than 125 psi—for drilling oil or gas wells, or testing pipe lines—get it at lowest cost with this flexible combination of Schramm Portable Compressors and Boosters. By varying the combination of units, you get desired volumes and pressures—from 125 cfm at 100 psi up to 1800 cfm at 500 psi.

Each of the four Model 600 Schramm Compressors shown here delivers up to 600 cfm at pressures up to 100 psi. If you need more pressure, two of the compressors (at slow speed) and one booster will deliver 900 cfm at 500 psi. Three compressors (running at rated speed) give up to 1800 cfm at 500 psi. You get exactly what you need on your job.

Compressed air drilling of oil and gas wells becomes more practical than ever with this flexible, economical system of portable units. Schramm combinations increase penetration rates by 40% to 237% over conventional rigs. Holes are cleaner and straighter. Mud cake is eliminated. Bits last up to 348% longer. Cuttings can be examined continuously. Core recovery is excellent. Cement requirements are lower. And the use of air, instead of mud, eliminates cost of water and chemical mud. Also, you have no lost-circulation problems when you drill with air.

If you have never used the Schramm method of drilling with air, your drilling costs may be as much as 50% higher than they should be. Start cutting them now; get full information on Schramm Portable Compressor-and-Booster Combinations. Free data sheet shows nine combinations available. Send for your copy and ask for full details of rotary rock drilling with Schramm Portable Compressors and Boosters. No obligation.

Schramm Portable Compressors and Boosters are easy to install. Simply wheel them into position, connect to manifold and begin drilling without further adjustment. All Schramm Boosters and Model 600 Compressors are powered by the same engine, either the International Harvester UD-1091 diesel or U-1091 gas engine. Result: fewer service parts, lowest maintenance.

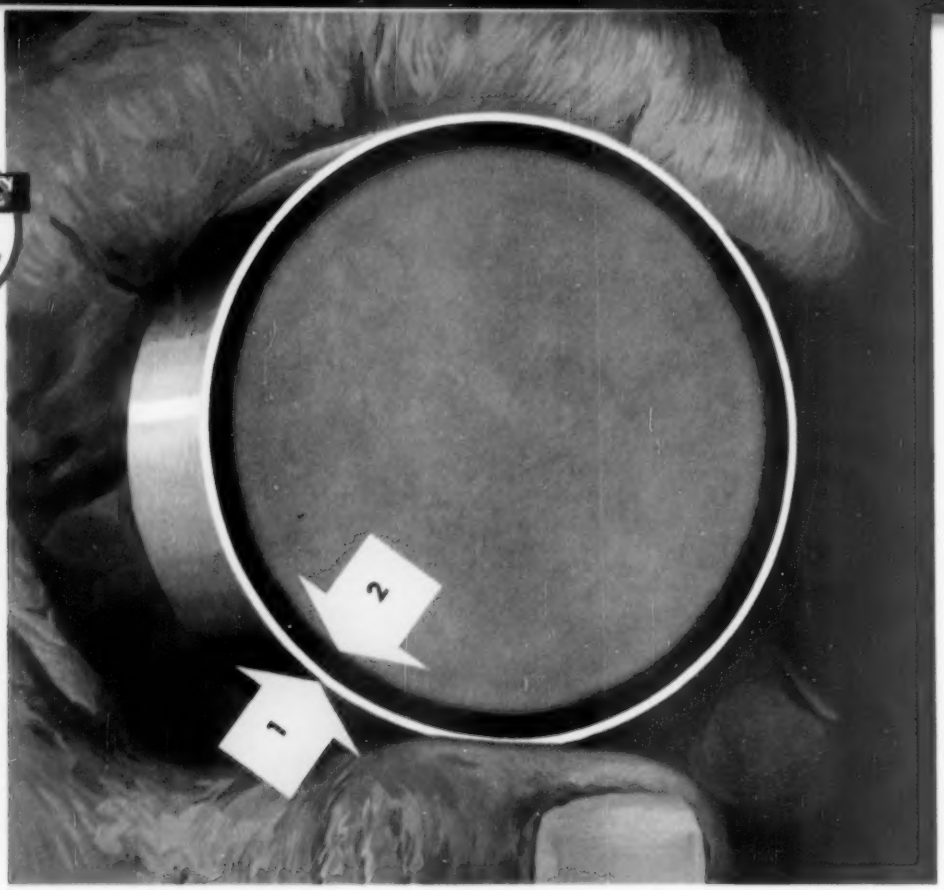
Schramm, Inc.

MANUFACTURERS OF AIR COMPRESSORS

630 North Garfield Ave. West Chester, Pa.

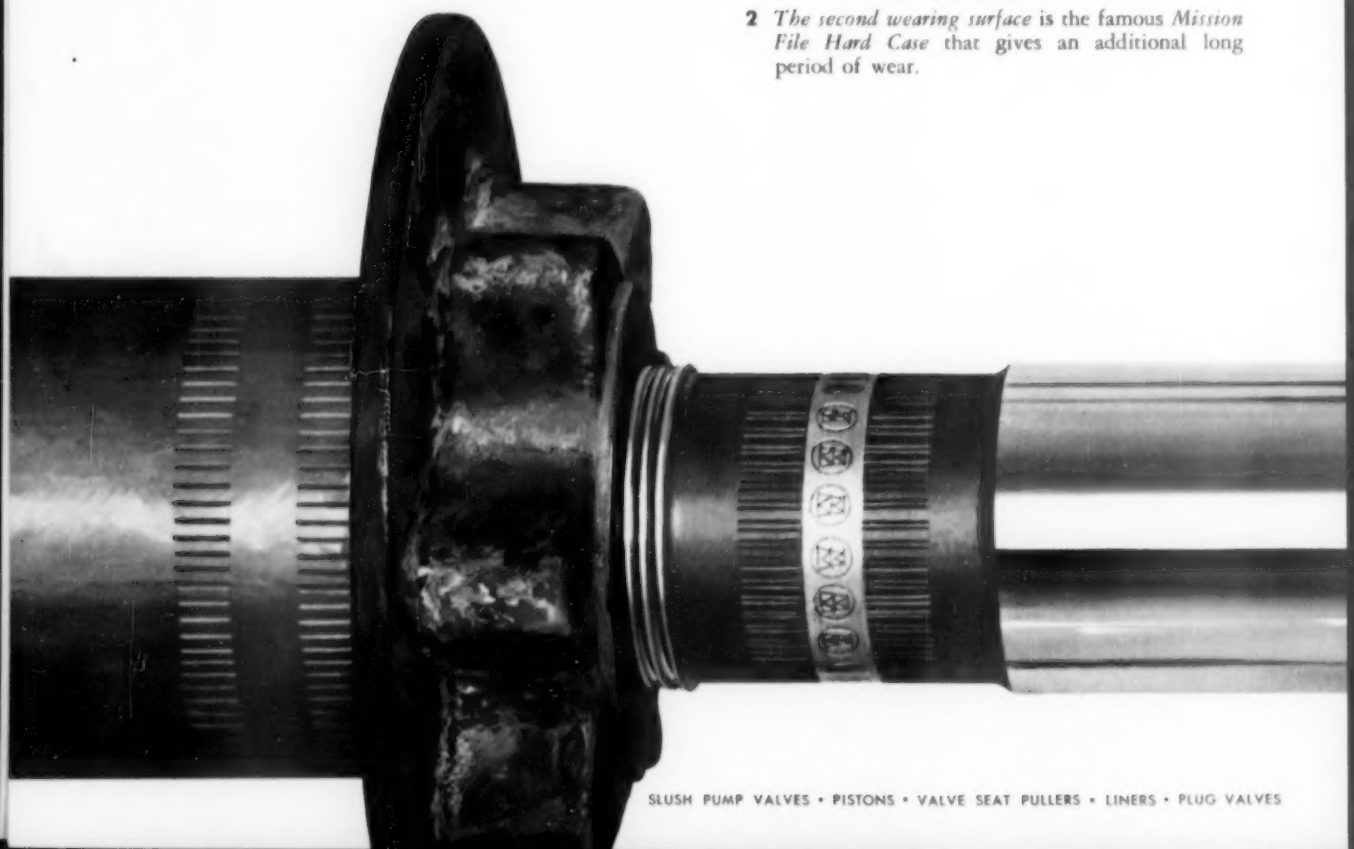
MISSION

SUPER CHROME PISTON RODS

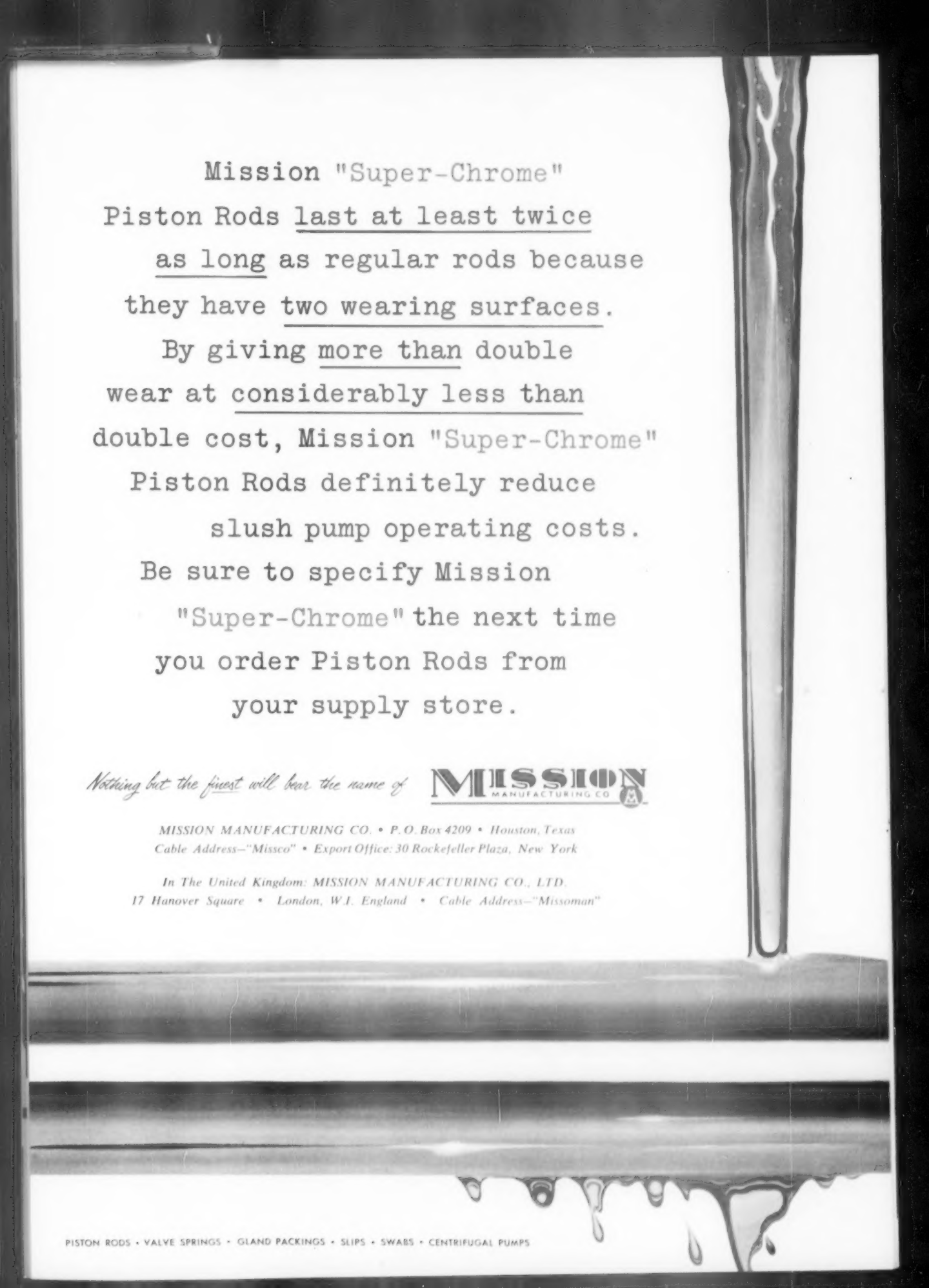


1 *The first wearing surface* is a *corrosion and abrasion-resistant hard chrome plate* that lasts as long or longer than a regular rod, and much longer under corrosive conditions.

2 *The second wearing surface* is the famous *Mission File Hard Case* that gives an additional long period of wear.



SLUSH PUMP VALVES • PISTONS • VALVE SEAT PULLERS • LINERS • PLUG VALVES


Mission "Super-Chrome"
Piston Rods last at least twice
as long as regular rods because
they have two wearing surfaces.
By giving more than double
wear at considerably less than
double cost, Mission "Super-Chrome"
Piston Rods definitely reduce
slush pump operating costs.
Be sure to specify Mission
"Super-Chrome" the next time
you order Piston Rods from
your supply store.
Nothing but the finest will bear the name of
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MISSION MANUFACTURING CO. • P.O. Box 4209 • Houston, Texas
Cable Address—"Missco" • Export Office: 30 Rockefeller Plaza, New York
In The United Kingdom: MISSION MANUFACTURING CO., LTD.
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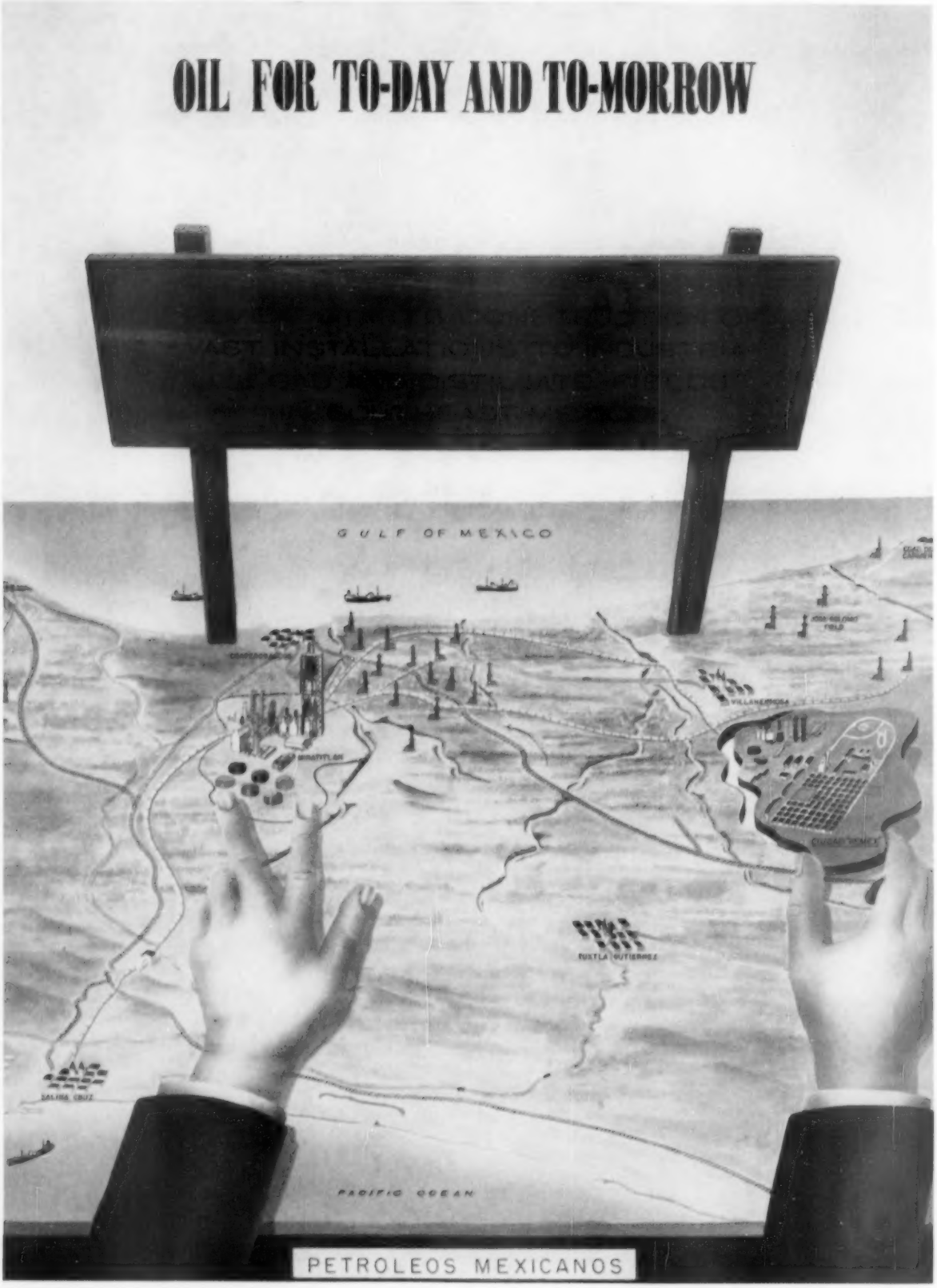
PISTON RODS • VALVE SPRINGS • GLAND PACKINGS • SLIPS • SWABS • CENTRIFUGAL PUMPS

OIL FOR TO-DAY AND TO-MORROW



Pipeline Patrol

Turkey, to Batman. **TECHINT** (Compagnia Tecnica Internazionale), Milano, Italy, has 205 miles of 4-in. from Bandirma to Eskisehir, Turkey, and 250 miles of 8-in. from Antalya to Eskisehir. Bids were taken in January 1956 on 300 miles of 12-in. between Marseille and Langres, France.

Foreign Natural-Gas Pipelines

• **Alberta Gas Trunk Line Co., Ltd.**
Project: 637 miles of 34 to 16-in. gathering lines in Alberta.
Contractor: **Dutton-Williams Brothers, Ltd.**, has preliminary studies, design and management-engineering.
Completion: Approximately 40 miles to be completed in 1956; remainder in 1957 and 1958.

Andes Pipeline Corp. (Subsidiary of Glenn McCarthy, Inc.)
Project: 500 miles of 12-in. from McCarthy's Bolivian concession to the Chile copper-mining area.
Contractor: Will do own work.

• **Attock Oil Co.**
Project: 60 miles of line from Dhulian field to Rawalpindi in West Pakistan.
Status: Planned.

Cia. Shell de Venezuela.
Project: 177 miles of 20-in. from La Paz field in the Maracaibo district, to the Cardon refinery on Paraguana Peninsula, to fuel refinery furnaces.
Status: Under way.
Completion: 1957.

• **Empresa Nacional Del Petroleo.**
Project: 80 miles of 10-in. from Concon to Santiago, Chile.
Status: Planned.
Project: 130 miles of 22-in. to parallel a 14-in. line from Reynosa to Monterrey in northern Mexico.

Imperial Oil, Ltd.
Project: 37 miles of 12-in. from Waterdown to North Toronto, Ont.
Status: Under way.
Contractor: **Majestic Contractors, Ltd.**, Odis Hare, spread superintendent, office at Cooksville, Ont.

Inland Natural Gas Co., Ltd.
Project: 350 miles of 12 to 4-in. system in British Columbia, and 400 miles of distribution piping in 31 towns.
Status: Clearing and grading under way.
Contractor: **Dutton-Williams Brothers, Ltd.**; Pat Campbell, project manager, office at Penticton.
Completion: September 1957.

Mid-Western Industrial Gas, Ltd.
Project: 18 miles of 6-in. from the new gas plant at Redwater, Alta., to the nickel plant at Fort Saskatchewan, including a crossing of the North Saskatchewan River.
Status: Under way.
Contractor: **Fulton Banister, Ltd.**
Completion: Fall 1956.

South Alberta Pipe Line, Ltd.
Project: 150 miles of 8-in. from Etzikom field to serve a nitrochemical plant to be built near Medicine Hat, Alta.
Status: Filed for permit.

Sui Gas Transmission Co.
Project: 188 miles of 16-in. from Sui gas field to Moultan, Pakistan.
Status: Under way; to be extended later to Lahore with branches at Kot Addu, Jhang, Magiana, and Montgomery.
Contractors: **Pakistan Constructors,** a joint company of **Morrison-Knudsen** of Boise, Idaho, and **William Press, Ltd.**, of London.

• **Trans-Canada Pipe Lines, Ltd.**
Project: 574 miles of 34-in. from the Alberta-Saskatchewan border to Winnipeg. (First part of 2,250-mile line from Alberta to Toronto and Montreal.)
Status: Under way.
Contractors: **Majestic Contractors, Ltd.** (104 miles from Burstall to Stewart Valley, Sask., R. L. Leaonard, spread supt., office at Cabri.; **Canadian Bechtel, Ltd.** (110 miles from Swift Current to Moose Jaw, Sask., J. L. Work, general superintendent, office at Moose Jaw); **Mannix, Ltd.** (90 miles from Moose Jaw to Welseley, spread superintendent, T. Anderson, office at Montmartre, Saskatchewan); **Dutton-Williams Brothers, Ltd.** (87 miles from Deveren to Moosomin, to start in 1957).

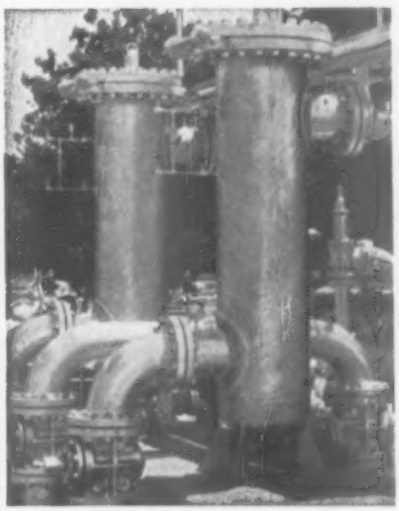
Union of Soviet Socialist Republic.
Project: 900 miles of 26-in. from Stavropol in the Northern Caucasus to Moscow. The line, larger than Russia's other two major gas lines which are only 16 and 18-in., will serve Voroshilovgrad, Voronezh, Tula, Yelets, and Serpukhov.
Status: Under way; approximately 50 per cent completed.

Westcoast Transmission Co., Ltd.
Project: 650 miles of 30-in. from Peace River area, Canada, to Sumas, Wash.
Status: Under way.
Contractors: **Dutton - Williams Brothers, Ltd.**, has 120 miles from Taylor, B. C., to Azouzetta Lake, T. E. Davis, spread supt., office at Dawson Creek, B. C.; **Mannix, Ltd.**, has 110 miles between Huntingdon and Merritt, Fred Byers, spread superintendent, office at Chilliwack; **Canadian Bechtel, Ltd.**, has 210 miles from Alexandria to Pine Pass, B. C., H. F. (Hank) Mogg, spread man, office at Quesnel, B. C.; **R. A. Conyes Construction Co.**, has 210 miles.
Completion: Dutton-Williams section to be completed November 1957. R. A. Conyes section and Canadian Bechtel section to be completed September 1957.

MOORLANE

GAS SCRUBBERS

AN ESSENTIAL ACCESSORY
FOR ALL GAS PIPE LINE SYSTEMS



Sizes available are 4-inch through 18-inch diameter vessels for any working pressure.

•

Capacity — up to 34,000,000 standard cubic feet per day.

•

Scrubber is dry type. No oil carry-over to worry about.

•

Filter medium is wool felt.

•

Removes all particles 5 microns (.0002") in size, and larger.

Efficiency remains constant from very low flows to extremely high volumes.

•

Low initial cost.

•

Inexpensive to operate and maintain.

WRITE FOR YOUR COPY OF BULLETIN NO. 457 FOR DESCRIPTION AND PRICES

MOORLANE COMPANY
409 EAST ARCHER
TULSA 1, OKLAHOMA

Dowell service engineer controls each step in deepening drainage channels with Channeling Acid treatment.

Operation for leveling decline curves

Channeling Acid has proved its effectiveness in smoothing out production decline curves—treatment after treatment.

For example, a well originally completed in a dolomitic limestone formation in 1939 was given a standard acid treatment in 1950. Tests indicated 15 BOPD pumping. In 1952 Dowell engineers recommended Channeling Acid to increase production. The treatment consisted of 1500 gallons of Channeling Acid followed by 10,000 gallons of silicate control acid. Production increased to test 114 BOPD pumping. *More than three years later the well is still an excellent producer, pumping its allowable of 38* BOPD.

Channeling Acid is an exclusive Dowell treatment that creates new passages for oil trapped deep in formations. Chemical agents make this possible by temporarily sealing off most of the pore spaces, allowing the acid to direct its attack on certain pores and form long drainage channels. The film-forming agents then break down and flow freely to the well bore.

For more information or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write to Dowell Incorporated, Tulsa 1, Oklahoma, Dept. K-11.

services for the oil industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

The OIL AND GAS JOURNAL

Showcase

by Dan B. Miller

Pipeline Enamel Primer Dries in One Hour

A new enamel primer developed for gas distribution and oil and gas transmission companies is specifically designed for use where its fast-drying characteristics are of importance. Bitumastic Jet-Set is ready for enameling after 1 hour. In cold weather and under adverse humidity conditions, it is ready for enameling in 8 hours or less. The use of Bitumastic Jet-Set enables distribution and transmission companies to make repairs and back-fill rapidly, thus reducing inconvenience to the public and speeding their own operations.

Applied by brush or spray, the coating material covers at the rate of between 400 and 500 sq. ft. per gallon. At this rate, it will dry to touch in from 1 to 15 minutes. **For more information write or call: Tar Products Division, Koppers Co., Inc., Pittsburgh 19, Pa.**

●

Reverse-Reduction Unit Made for 5-Hp. Engines

This new reverse-reduction unit offers users of gasoline engines complete power control. It incorporates a 2:1 reduction, definite neutral and positive forward and reverse. The unit is enclosed in an oil-tight housing which bolts to the engine crankcase, forming one integral package. The manufacturer supplies the unit separately or the unit and engine completely assembled.

A feature of the unit is the double acting, precision machine-tool clutch with over-center shift mechanism. This type of clutch permits the operator to shift instantly from forward to reverse or to neutral at any engine speed. Inching and braking are also easily accomplished with only finger-tip pressure on the shift lever. **For more information write or call: J. B. Foote Foundry Co., Fredericktown, Ohio.**

●

Airplane Features Land-O-Matic Gear

The new Model 172 business utility airplane features land-o-matic gear. Handling very similar to an automobile during takeoffs and landings, the new wide-span gear permits the pilot to drive the airplane down the runway, into the air, and back on to the ground. The low center of gravity allowed by the new type gear provides excellent maneuverability, ease of landing, and ground handling.

Cost of operating the all-metal, four-

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CITY _____ STATE _____

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the HOT ROD of the OIL FIELDS

COOPER *model TR Unit.*

Just one of many models of Cooper units built to service any depth well on land or marine locations—with speed and safety.

The big 420 and 520 Series with torque converter drive and torqmatic full torque shifting transmissions provide the ultimate in speed and smooth shock-free power. Designed for the toughest jobs of servicing and workover on the deepest wells. Built in single engine self-propelled models and skid type for truck or trailer mounting.

The Cooper P and A Separate Engine (skid type) Models with standard transmission drive for truck or trailer mounting are built in a complete range of sizes. Cooper Units can be powered by gas or diesel engines.

Above: Powered by truck motor — four sizes in either single or double drum models, for servicing to 10,000 ft.

FRED E. Cooper, Inc.

P. O. Box 1890 TULSA, OKLA.

Branches: Houston, Odessa, Los Angeles, Olney

place 172 may be compared to the cost of owning and operating an automobile. Figuring the national averages for flying costs, if the business man flies 300 hours annually or about 37,000 miles, his cost per airplane mile amounts to less than 11 cents per mile. If he flies 500 hours or about 62,000 miles annually, this cost is reduced to less than 8 cents per mile. These costs include gasoline, oil, maintenance, hangar charges, depreciation, and insurance.

Powered by a 145-hp., six-cylinder Continental O-300-A engine, the airplane has a maximum recommended cruise speed of 124 m.p.h. Range at maximum recommended cruise of the airplane is 519 miles or 4.2 hours with a true air speed of 124 m.p.h. **For more information write or call: Cessna Aircraft Co., Wichita, Kans.**

●

Purifier Recovers Chemicals From Vapors and Gases

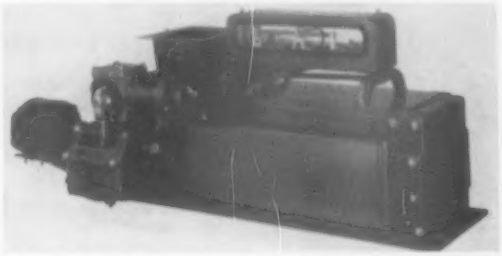
A new device recovers valuable minerals and liquids vented to atmosphere by industry. Model LUS Hi-eF purifier separates mist, liquids, and solids of any type from any gas or vapor by a series of vanes and baffles through the correct application of principles of centrifugal force. It removes 99 per cent or better of all liquid and solid particles in vapors and gases under normal operating conditions.

The purifier eliminates screens or filters. This permits the design of a much smaller unit, as separation is accomplished in a relatively small area by

a compact separating element. The purifier is maintenance-free and no parts require cleaning or replacement. On gas lines the separated entrainment is ejected automatically by a float trap, on steam lines by a steam trap. **For more information write or call: The V. D. Anderson Co., 1935 West Ninety-Sixth Street, Cleveland 2, Ohio.**

OIL AND GAS JOURNAL Showcase

.....OF NEW EQUIPMENT



Feeder Uses Pneumatic Instrumentation

A new continuous gravimetric feeder utilizes pneumatic instrumentation. The pneumatic scale feeder is controlled by a 3 to 15 psi. air signal set manually or automatically in proportion to an air signal from an external source. The feeder guarantees minute to minute accuracy of ±1 per cent over a 3 to 3,000 lb. per minute feed range. The unit is ideally suited for continuous blending or automatic batching operations.

The new feeder features recording and integration of feed rates from a measured air signal. Since the only electrical component in the unit is a synchronous motor for driving the weigh belt, the feeder is suitable for use in hazardous locations. Adjustable, dust and explosionproof over-and-under feed alarms are available. **For more information write or call: Wallace & Tiernan, Inc., 25 Main Street, Belleville 9, N. J.**

●

Automatic Instrument Inspects Tube, Wire, Rod

The new, automatic Magnatest FW-400 inspects nonmagnetic rod, wire, tube, and bar. The instrument detects such problems as seams, overlapping, diameter changes, inclusions, voids, concentrated porosity, metallurgical variation, and splits.

The FW-400 itself is a series of instruments covering the whole range of nonmagnetic materials from aluminum, brass, and copper to tungsten, austinitic stainless, and titanium in a range of diameters from 1/64 to 3 in. It is designed to function on production lines or in laboratories.

An FW-400 operates at production speeds in excess of 150 to 300 f.p.m.

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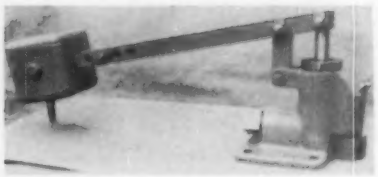
OIL AND GAS JOURNAL **Showcase** ..... OF NEW EQUIPMENT

without personnel. It is equipped with automatic signaling and recording devices, and works equally well on cut or continuous lengths. **For more information write or call: Magnaflux Corp., 7300 West Lawrence Avenue, Chicago 31, Ill.**

Pump Delivers Inhibitor Solutions to Pumping Wells

The C/P 100 chemical pump utilizes power from the walking beam to deliver corrosion, scale, or wax-inhibitor solutions to pumping wells. It is for use on wells requiring large volumes of solutions. It delivers from 5 to 100 gal. per day into the casing head or flow line. The rate depends upon the length of the piston stroke and the speed of the walking beam. A small cable or chain fastens with one end to the walking beam. The other end fastens to the driving arm of the pump. The pump plunger delivers fluid on the upstroke of the walking beam, and a weight on the end of the driving arm returns the arm to its lower position.

The C/P 100 chemical pump handles any well fluids. Where clean water or oil is not available for solutions, field tests have shown that the pump will readily handle well fluids consisting of oil, water, emulsion, or wax in most



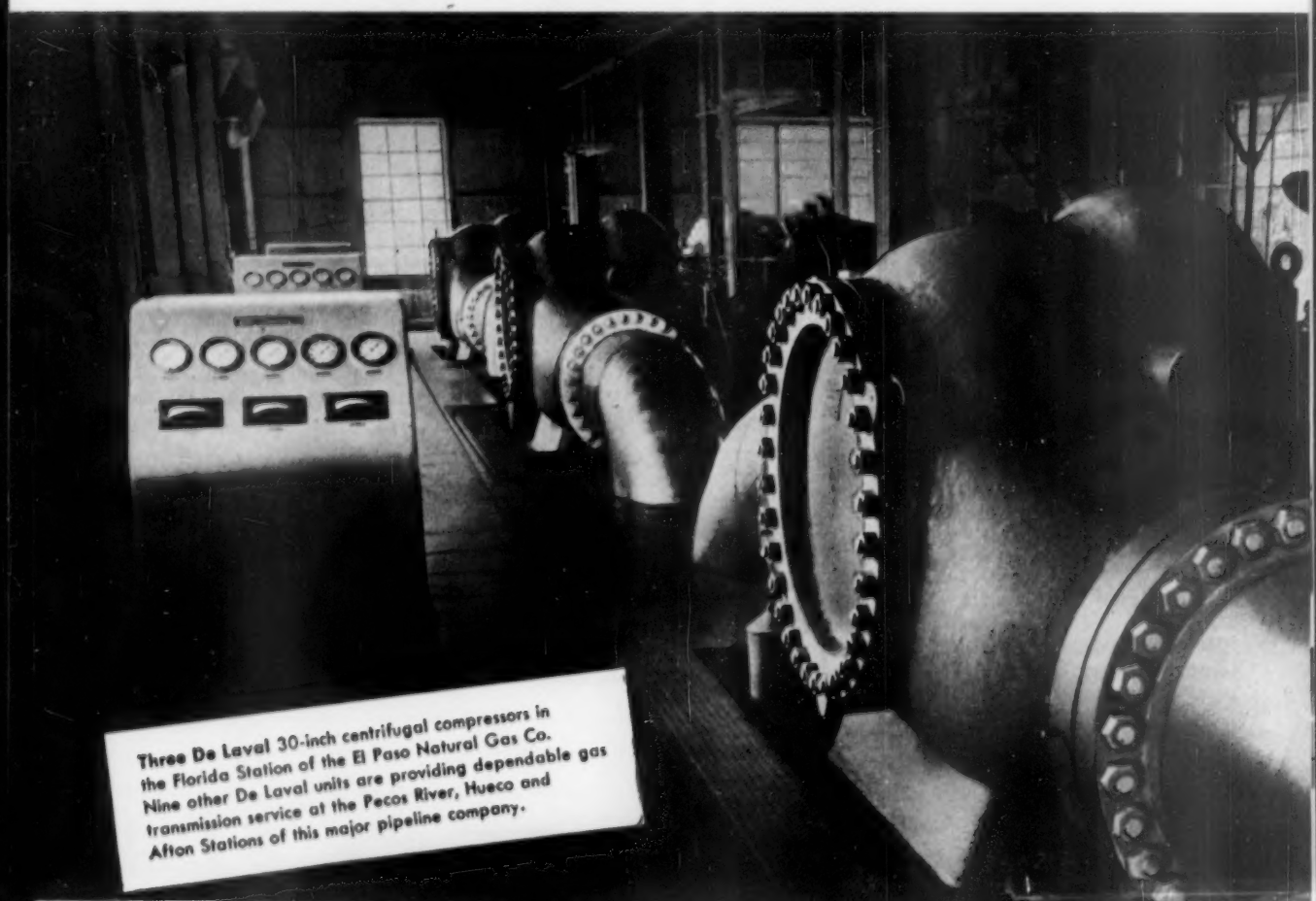
combinations. It is easy to install and regulate. **For more information write or call: Monarch Engineering Corp., 15805 South Main Street, Gardena, Calif.**

●

Pitot Tube Checks Flow Of Pipeline Fluids

This adjustable pitot tube checks the flow of corrosive and noncorrosive pipeline fluids. The new tube, in operation at refineries, is available in stainless steel, monel, and other metals. This probe is adaptable to existing con-

ventional meters measuring high flow rates. A safety lock permits the pitot tube to be secured in any desired position providing operational safety especially when running a traverse. The tube fits either male or female con-



Three De Laval 30-inch centrifugal compressors in the Florida Station of the El Paso Natural Gas Co. Nine other De Laval units are providing dependable gas transmission service at the Pecos River, Hueco and Afton Stations of this major pipeline company.

nections through gate or corporation valve installations. Standard lengths run from 1 to 5 ft. **For more information write or call: C-Mar Corp., Manasquan, N. J.**

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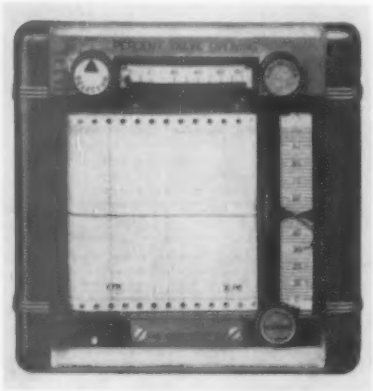


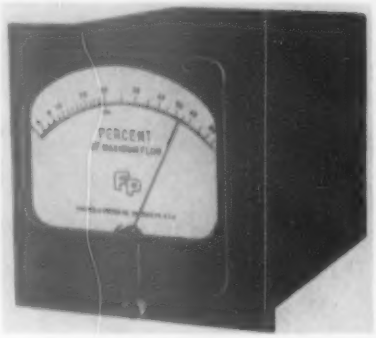
Unitized Controls Feature Plug-In Construction

A new line of unitized Autronic controls electronically operates to control industrial process equipment and ventilation equipment. The controller, recorder (or indicator), and manual control are of plug-in construction. By unitizing, a universal-mounting case takes any combination of plug-in units. This mounting requires only a single, standard 5 by 5-in. panel cutout. It eliminates wiring between individual instruments. The instruments pull out of the panel for calibration, test, or maintenance without employing jumpers and without upsetting system balance. **For more information write or call: The Swartwout Co., 18511 Euclid Avenue, Cleveland 12, Ohio.**

●

Device Indicates Flow Rate From Turbine Meter Signals

A new flow-rate indicator operates with the manufacturer's turbine-type primary metering elements. Known as the industrial logarithmic panel indicator, the new indicator converts the output signal of the turbine meter into a series of pulses of constant amplitude at a frequency equal to that of the turbine-meter output and, therefore, proportional to volumetric-flow rate.



These pulses integrate in a direct current milliameter providing an indication proportional to frequency and to flow rate. External terminals are provided for pulse and direct current millivolt output signals. A shaded pole panel meter with a logarithmic characteristic provides uniform rate accuracy of 2 per cent at a short term repeatability of 0.5 per cent of rate. **For more information write or call: Fischer & Porter Co., Hatboro, Pa.**

DE LAVAL

CENTRIFUGAL COMPRESSORS

on the job at El Paso Natural Gas

De Laval centrifugal compressors offer many important engineering features. (1) They are designed to handle an increased ultimate flow, can be quickly converted to larger capacities by replacing the impeller, diaphragm and a few minor parts. (2) The high pressure shaft seal eliminates leakage, consumption of sealing oil is negligible. (3) There is only one moving part—the rotor—which has ample clearance. (4) Units are compact, require smaller foundations and smaller stations. (5) First costs and installation costs are low.

Bulletin 503 gives data on De Laval Centrifugal Compressors. Write for your copy.

DE LAVAL *Centrifugal Compressors*

DE LAVAL STEAM TURBINE COMPANY

810 Nottingham Way, Trenton 2, New Jersey

Right from the start—

For more than forty years UOP has been the leading independent petroleum research organization. Over the years it has been responsible for the development of many of the most important refining processes now in use. The results of UOP research have always been made available to all refiners, anywhere in the world.

In cooperation with the technological and manufacturing staffs of these refiners the application of these processes has made a major contribution to the continuing betterment and marketability of petroleum products.

Forty Years Of Leadership In Petroleum Refining Technology

Research is working to make petroleum products better

Throughout the great petroleum industry there are thousands of scientists, technicians, engineers devoting their efforts exclusively to research. Their efforts range from the development of an abstract theory in the laboratory to the practical application of it in the field or at the refinery.

Yet, right from the start, most everything that is done in petroleum research concentrates on the development of improved products from petroleum, products better fitted to answer the demand of today's economy, products that fill as well as anticipate the growing public need.

Research, too, is devoted to the task of helping the refining industry get the most out of every barrel of crude that is processed in its plants. This makes possible the economical manufacture of petroleum products and their availability to the broadest markets at reasonable prices.

We have a lot of these men of science here at Universal, and there are lots more on the research staffs of refiners everywhere. It is good to know that their efforts are concentrated on the continual improvement of petroleum products, a satisfying assurance that the oil industry will continue to fulfill its responsibilities.

UOP®

UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD, DES PLAINES, ILLINOIS, U.S.A.

OIL AND GAS JOURNAL

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- CATALOGS
- BROCHURES

Index of Instrumentation Literature. Bulletin G-2, an index of industrial division literature, covers catalogs, bulletins, specification sheets, data sheets, illustrated lectures, and articles from Instrumentation Magazine. **For more information write or call: Minneapolis-Honeywell Regulator Co., Wayne and Windrim Avenues, Philadelphia 44, Pa.**

●

Cochrane Hot Lime-Zeolite Water-Conditioning Systems are described in Publication 4801-A. This two-color, four-page publication explains how zero-hardness boiler-feed water can be provided. Advantages listed include savings in chemical costs, lower CO_2 in steam, and lower alkalinity. The zeolite stage may be added to the existing hot-process installation and the system may be made automatic. Flow charts explain the down-flow and the sludge-blanket type. **For more information write or call: Cochrane Corp., Seventeenth Street below Allegheny Avenue, Philadelphia 32, Pa.**

●

Big Tracks is a 12-page, 2-color booklet describing this company's largest crawler tractors. Form DE 627, illustrates the design of the D6, D7, D8, and D9, engineered to perform big jobs fast and economically. Long-life features of construction, not easily seen from the outside are covered in detail. The booklet explains how ease of operation allows the operator to get more production out of a day's work. **For more information write or call: Caterpillar Tractor Co., Peoria, Ill.**

●

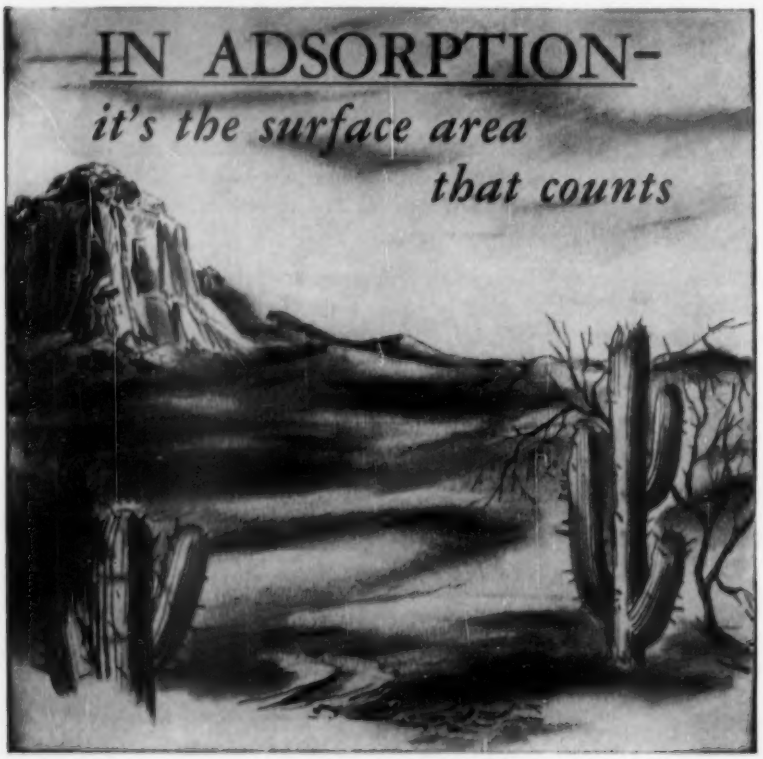
Bailey Meters and Contro!s is the title of Bulletin G15-1. It describes over 100 measuring, transmitting, receiving, recording, and indicating instruments and control components for power and process applications. It includes detailed reference for each product as well as 24 instrument and control applications. It makes use of photographs, charts, and drawings. Addresses and phone numbers of all district offices are also listed. **For more information write or call: Bailey Meter Co., 1050 Ivanhoe Road, Cleveland 10, Ohio.**

●

Kaiser Aluminum Jacketing Materials and Methods, an illustrated manual, details information of aluminum insulation jacketing for tanks, vessels, and piping systems of the petroleum and chemical process industries. Containing 40 pages, the manual offers complete recommendations for selecting, fabricating, and installing the various aluminum-jacketing components. In addition to showing methods for jacketing tanks, vessels, and straight runs of piping, the booklet shows how to jacket fittings and heads. Photographs, drawings, and tables are included throughout for easy reference. **For more information write or call: Kaiser Aluminum & Chemical Corp., Kaiser Building, 1924 Broadway, Oakland 12, Calif.**

●

Otis Wire-Line Tools for Running and Pulling all Otis Subsurface Controls. This data sheet contains labeled line drawings of a wire-line assembly and a wire-line stuffing-box assembly. The sheet presents information on the running, locking, and pulling of the subsurface wire-line assembly. It also points out the features of the stuffing



Dryer than the desert—extremely porous—the multitudinous particles of Florex Fullers Earth possess an adsorptive capacity unequalled by any other known natural material. Consisting of crystals of colloidal size and fibrous shape, Florex assures maximum effectiveness. Florex is so economical that 50 acres of adsorptive surface costs less than a penny.

Florex is particularly superior in the adsorptive refining, decolorization, clarification and neutralization of mineral, vegetable, and animal oils, fats and waxes and for processes involving the use of highly active clay for sweetening light distillates, dehydrations, desulfurization, and polymerization.

Available in all standard particle sizes, special Florex meshes may also be ordered.

Floridin maintains a modern laboratory with highly specialized equipment for the proper evaluation of your adsorption problems. Technical data, samples, quotations, and the services of staff technicians are available upon request.

FLORIDIN COMPANY

Adsorbents
Desiccants
Diluents

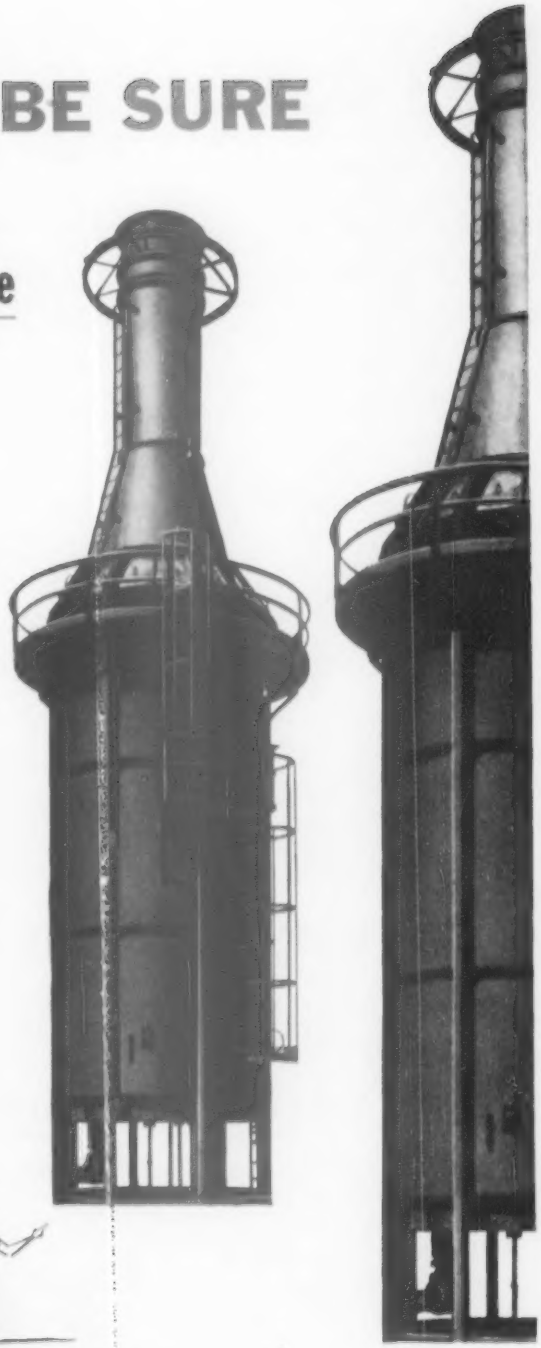
Dept. C, Box 989 Tallahassee, Florida

YOU, too, CAN BE SURE

petrochem-isoflow furnaces

are most economically desirable

by any comparison



Whenever *all* the specifications and *all* the operating requirements are applied to direct-fired furnace design, you can be sure PETROCHEM-ISOFLOW FURNACES will be found most economically desirable, by any comparison.

In making comparisons it is essential to take these factors into consideration:

1—Average radiant transfer rate.
2—Maximum deviation from average radiant transfer rate.
3—Average and maximum transfer rate in convection section.
4—Maximum tube wall temperature, radiant or convection.
5—Maximum efficiency with specified excess air.
6—Controlled thermal recirculation of flue gases to provide even heat distribution throughout full length of each tube and equalized heat distribution around each tube.
7—Overload and corresponding transfer load.
8—Design to provide: structural column supports—Ladders—Platforms—Tube Removal facilities, etc.
9—Degree of assembly; of the furnace structure and of the heating surface.

When you specify PETROCHEM-ISOFLOW FURNACES . . . you'll be in good company. More than 1500 are now in service, performing to the complete satisfaction of their operators and usually well beyond their rated capacities.

PETROCHEM-ISOFLOW FURNACES

UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

PETRO-CHEM DEVELOPMENT CO., INC. • 122 EAST 42nd St., New York 17, N. Y.

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Rowson & Co., *Houston* • Wm. H. Mason Co., *Tulsa* • Lester Oberholtz, *Los Angeles* • Faville-Levally, *Chicago* • O. D. Foster, *Pittsburgh* • Turbox, *Philadelphia* • Flagg, Brackett & Durgin, *Boston* • O. M. Wallace & Co., *Denver & Salt Lake City*

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box and includes tables of threads, lengths, weight, and pressure for the equipment described. **For more information write or call: Otis Pressure Control, Inc., P. O. Box 7206, Dallas, Tex.**

●

Clark CFA, HMAB, and Air-Pack Compressors. This 54-page, 2-color brochure details three compressor models. It gives specifications, dimensions, photographs, and uses. The Model CFA is a compact, portable, balanced-opposed, packaged compressor unit. The Model HMAB is a two-cycle, right-angle, gas-engine-driven compressor. With three sizes, the Model HMAB produces 330, 440, or 550 hp. The third section of the brochure covers the Air-Pac, an automatic, 500-hp. compressor station designed for air and aerated-mud drilling. An engineering article on aerated-mud drilling points out advantages of this method. **For more information write or call: Clark Brothers Co., Olean, N. Y.**

●

Unibestos Insulation is the title of a new catalog on pipe insulation. Containing 40 pages, it is designed as a convenient reference guide. It presents a new way to specify proper thickness for pipe insulation, based on the J factor. This index eliminates much of the complicated computation formerly required. Detailed drawings show how single-layer Unibestos is applied to various vertical and horizontal expansion joints as well as to pipe bends, flanges, valves, and fittings. Physical and thermal characteristics are clearly presented and illustrated with charts and tables. **For more information write or call: Union Asbestos & Rubber Co., 1111 West Perry Street, Bloomington, Ill.**

●

Wirthco Rotary Tables. This 12-page, 2-color booklet illustrates and describes rotary tables and parts manufactured by a German firm. It utilizes labeled engineering drawings and photographs to point out features of the machines. Tables present sizes and weights. The booklet includes a listing with pictures of bushings, slips, and other tools used in the drilling operation. Also included is a description of a rotary-table and drive-unit with diesel engine and torque converter. **For more information write or call: Alfred Wirth & Co., Erkelenz (RHLD.) Germany.**

●

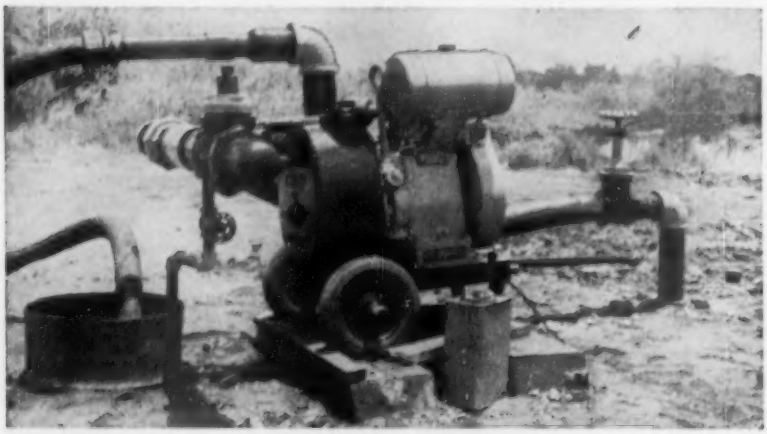
Diaphragm Valves. A new 2-color, 12-page catalog No. 100 describes diaphragm valves in terms of their advantages, applications, and specifications. The three basic types of valve operations are shown and dimensional specifications are given. Information is also included on plastic bodies and diaphragms. **For more information write or call: Hills-McCanna Co., 2443 West Nelson Street, Chicago 18, Ill.**

●

Detroit Diesel Turbopower. A new illustrated brochure lists specifications of industrial and marine engines ranging from 159 to 300 b.hp. It describes features of design and performance. The three-color brochure utilizes photographs, cutaway pictures, and performance graphs. **For more information write or call: Detroit Diesel Engine Division, General Motors Corp., Detroit 28, Mich.**

●

General American Services and Products, a 26-page multicolor brochure illustrates the products and facilities of all the divisions and subsidiary companies. Included are GATX tank cars, Wiggins tanks, Fuller Co. blowers, and custom fabricating, design, and engineering services. **For more information write or call: General American Transportation Corp., 135 South La Salle Street, Chicago 90, Ill.**



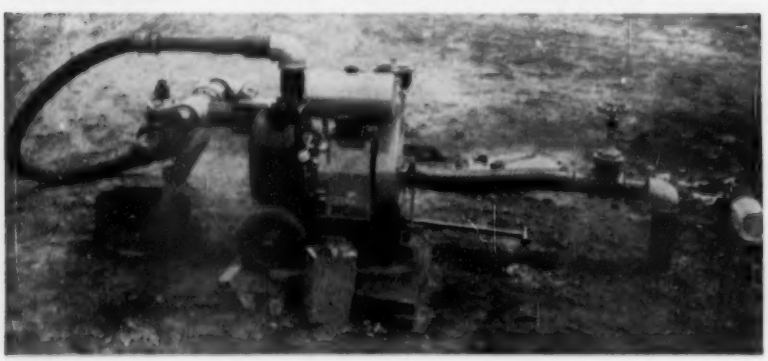
Any way you look at it—

CMC **DUAL PRIME PUMPS** are your best buy!

• These pumps are especially built for oil field service in a large variety of sizes and models. Each Dual Primer is a compact, ready-to-run unit that can be used for either suction lift or booster pumping. Write for latest Pump Bulletin.

CONSTRUCTION MACHINERY COMPANY, Waterloo, Iowa

Pictured above & below, CMC Model 37-N on a typical oil field gathering operation.



COOPER SPECIAL SERVICE UNITS

COOPER CORING, BAILING AND SWABBING WINCH
A very compactly designed unit having Single Line Pull of 30,400 lbs. Drum Capacity 14,000 ft. of 9/16 in. line.

Cooper standard oil field Winch Units can be easily and economically converted to handle Special Jobs, in-and-out of the oil fields.

These separate engine winches for truck or trailer mounting have been used for everything from pulling "big inch" pipe line river crossings to erecting TV towers.

When extra line capacities, special operating characteristics or extra heavy line pulls are required Cooper builds the unit.

COOPER PIPE LINE RIVER CROSSING WINCH
Single Line Pull 380,000 lbs. Drum Capacity 6,700 ft. of 1 in. line. Brakes: 52 in. dia. x 10 in. wide face.

COOPER TRAILER MOUNTED WINCH UNIT
Used for rig building and general construction work in Africa. This easily portable unit can be pulled by pick-up or light truck. Single Line Pull 12,000 lbs.

COOPER 2 DRUM WINCH UNITS
Used in the erection of tall TV towers. Both drums have same line speeds and line pull. Single Line Pull 27,000 lbs. Drum Capacity 4,100 ft. of 9/16 in. Line.

Cooper engineering is always available to help with your special requirements. Your inquiry is invited.

Originator of Mobile Winch Units

FRED E. Cooper, Inc.

P. O. Box 1890 TULSA, OKLA.

Branches: Houston, Odessa, Los Angeles, Olney

EQUIPMENT MEN . . . in the News

Graver Promotes D'Aragon To General Sales Manager

The advancement of Henry J. D'Aragon to general sales manager has been announced by Graver Tank & Manufacturing Co., Inc. D'Aragon heads Graver's national sales organization for steel and alloy tanks and vessels, both shop-built and site-erected. Though his headquarters will be at the Graver plant in East Chicago, Ind., he will spend much of his time in Graver's sales offices throughout the country.

D'Aragon has been with Graver 15 years, mostly in New York, where he was manager of Graver's eastern sales.

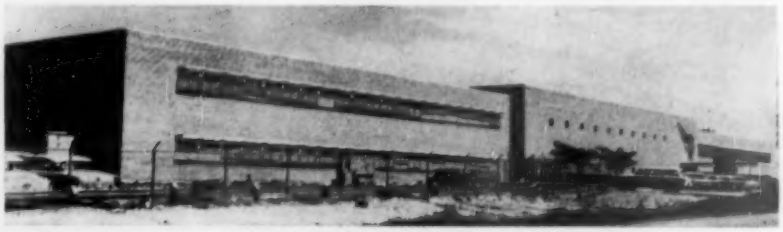
Rolo Names Truitt as General Sales Manager

C. B. TRUITT

C. B. (Ike) Truitt has been named general sales manager for Rolo Manufacturing Co. of Houston, R. K. Franklin, Rolo president, has announced.

Truitt's 20 years experience has been devoted mainly to work with pressure vessels, controls and metering of crude oil.

W. M. Boren, formerly director of sales and engineering for Rolo, will now devote full time as director of engineering.



Halliburton Oil Well Cementing Co.'s technical center at Duncan, Okla., has a new wing (left) and more than 300 engineers, chemists, and technicians.

Halliburton Completes Major Expansions

Several major building projects have been completed recently by Halliburton Oil Well Cementing Co. at its Duncan, Okla., headquarters. Heading the list are a new 18,000-ft. wing at the company's technical center; a four-story 28,000-ft. addition to the administration building at Plant 1; and a 20,000-ft. metal fabrication building at Plant 2. Several other smaller buildings have also been erected at the company's Duncan plants this year.

President L. B. Meaders stated that already this year the company has increased its research and manufacturing facilities more than in any previous year.

With completion of the technical center addition, more than 50 engineers, chemists and technicians have been added to the 250-plus research group. The addition to the administration building increases by half the usable space in the structure and is the sixth time the building has been added to since it was built in 1934.

Adjoining the technical center are experimental wells for regular and air-drilling study. Two other experimental wells are operated by the company's electrical well services department, one near Lawton, Okla., and the other at the department's research laboratory at Houston

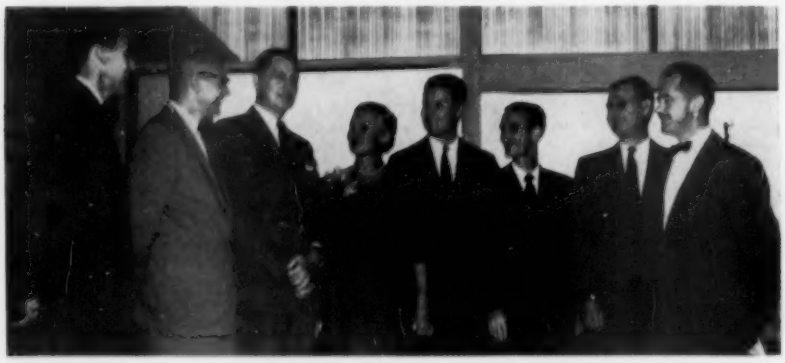
O-C-T Operates New Facility at Odessa

New warehouse and office facilities to give fast service to drilling and production areas in West Texas and southern New Mexico have been placed in operation in Odessa by Oil Center Tool Co.

Providing 6,000 sq. ft. of floor space, the structure includes complete christmas tree testing service. There are three separate test racks adaptable to any size flange. Warehousemen can assemble and test any size tree up to and including Series 1500 or 10,000-lb. test.

O-C-T's new and expanded operation enables its Midland-Odessa marketing section to have a pretested tree at the wellsite anywhere in West Texas or southern New Mexico in a matter of a few hours from the time the order is received, C. T. Jones, West Texas district manager, has announced. The rapid service entails an O-C-T warehouseman, Bill Jones, living next to the office.

O-C-T field service men living in Odessa are Louis Kluck and Bob Wright. Manager C. T. Jones and T. J. Buchanan work out of Midland but

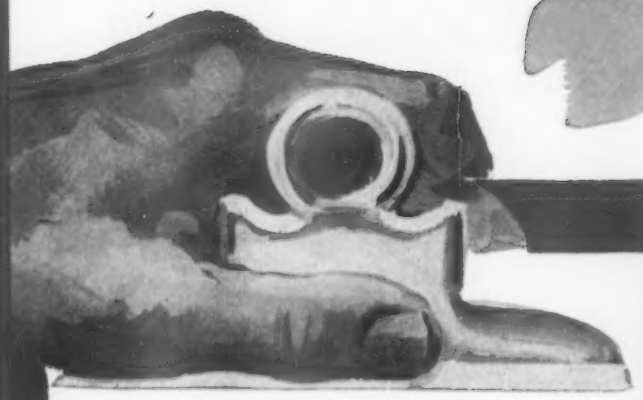


Nelson Open House Features Shop and Office Tour

Taking time out from greeting guests at the formal opening of their new plant and offices are these Nelson Electric Manufacturing Co. officers: Jackson Dean, manufacturing manager; Charles Saville, advertising and sales promotion manager; Hans A. Norberg, president and treasurer; Mrs. V. M. Nelson, vice president; C. B. Nelson, Jr., assistant secretary; Carl J. Nash, secretary, assistant treasurer and marketing manager; Dick Ray, chief engineer; and Ernest Schoenwald, assistant to the president.

More than 300 guests, including friends, customers, and suppliers representatives toured the new million-dollar facilities. Nelson sales engineers answered questions regarding the equipment being manufactured.

TOOLS + ...



- **Complete Log** of casing run and cementing time for your permanent records
- **Mud Log** during entire casing and cementing operations
- **Cement Log** for proper weight and quality during entire cementing operation
- **Recommendations** for scratcher and centralizer pattern, casing running speed and frequency and length of reciprocation
- **Installation** of all scratchers and centralizers
- **Supervision** of casing and cementing operation by an experienced field service man

...a turn-key job at no extra cost

This means . . . quality controlled tools . . . engineered casing job . . . qualified* field service men . . . backed by complete research facilities and experience gained from handling thousands of casing jobs . . . all of this at no extra cost.

WEATHERFORD *Oil Tool Co.*

*Weatherford men receive continuous technical training on an organized basis to guarantee you the best qualified man in the field to handle your casing job.

in conjunction with the Odessa warehouse. Another warehouseman specializing in assembling and testing is James Greenwade.

Greer and Alexander Promoted by Failing

Robert M. Greer, formerly first vice president of George E. Failing Co. of Enid, Okla., has been named president and treasurer of the company. E. L. Alexander, former vice president of

R. M. GREER

E. L. ALEXANDER

engineering and manufacturing, has been made first vice president. Announcement of the promotions was made following a meeting of the board of directors of the Failing company held at the Enid plant. The Failing company is a subsidiary of Westinghouse Air Brake Co., Pittsburgh, Pa.

Fritz W. Glitsch Holds Annual Sales Meeting

These are the men who attended the annual sales conference in Dallas for Fritz W. Glitsch & Sons, Inc., manufacturers of bubble trays, towers, and other distillation equipment. Above are: J. J. Tunno, New York City; S. G. Higginbotham, Los Angeles; M. C. Glitsch, vice president, Dallas; Hans C. Glitsch, president, Dallas; R. L. Allen, sales manager, Dallas; Nat Nesbitt, Cleveland. Standing: W. R. Greenman, Chicago; Tom Wright, Houston; H. L. Wimpee, Dallas; H. W. Reynolds, Uxbridge, Ont.; and Bryan Ross, Tulsa.

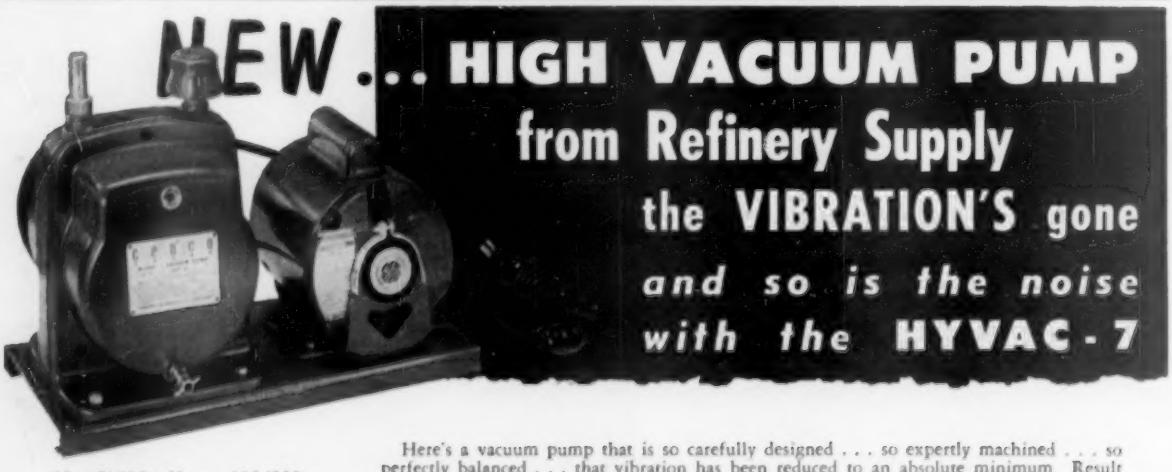
Continental Makes Changes In Personnel, Territories

Headquarters for Continental's West Texas-New Mexico division will be relocated in Midland, Tex., with R. L. Collier as division manager. Fort Worth, former headquarters for this division, will now be a sales office with C. A. Ross as the sales office manager.

The oil-field-supply company's district office at Midland will be moved to Odessa. From his new location, W. T. Hays, district manager, will have jurisdiction over Continental stores at Andrews, Kermit, Hadacol Corners, McCamey, Monahans, and Odessa, Tex.

The district office at Hobbs, N. M., has been moved to Lubbock, Tex. W. H. Long, Jr., district manager, will work with the Lubbock office and the Hobbs and Tatum, N. M., stores as well as Post and Sundown, Tex., stores.

J. B. Patterson will be district man-



No. 91505, 60 cy. 115/230 volts
$254.50

No. 91500, same as No. 91505, but without motor or base
$199.50

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The most complete line of scientific instruments and laboratory supplies in the world

Here's a vacuum pump that is so carefully designed . . . so expertly machined . . . so perfectly balanced . . . that vibration has been reduced to an absolute minimum. Result . . . smooth, quiet operation. You can hardly hear it as it runs. In fact, its noise level is lower than that of any similar pump.

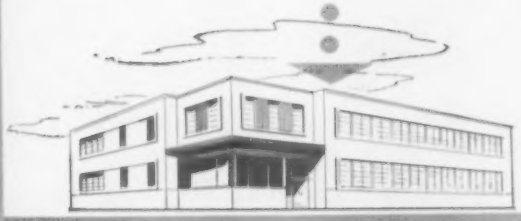
The new Cenco Hyvac-7 has more pumping capacity per cubic foot of space occupied than any other vacuum pump now available. It produces a free air displacement of 70 liters per minute and a guaranteed ultimate vacuum of 0.1 micron. This pumping speed in the low micron range is exceptionally high. The ratio of pumping speed at 1 micron to that at atmospheric pressure is 49%. And it pumps from atmospheric to ultimate pressure in less than five minutes.

This finest, most efficient of all vacuum pumps is now ready for shipment.

REFINERY SUPPLY COMPANY
621 EAST FOURTH STREET • TULSA 3, OKLAHOMA
2215 McKINNEY AVENUE • HOUSTON 3, TEXAS
CENTRAL SCIENTIFIC COMPANY
1700 IRVING PARK ROAD • CHICAGO 13, ILLINOIS
CHICAGO NEWARK BOSTON WASHINGTON DETROIT SAN FRANCISCO
SANTA CLARA LOS ANGELES TORONTO MONTREAL VANCOUVER OTTAWA

McKee expands again to give you

BETTER ENGINEERING AND CONSTRUCTION SERVICES



One of 15 specialized engineering groups in the McKee organization.

THERE are good reasons for the continuous growth of the McKee organization. Because of broad expansion of the industries we serve, our specialized, world-wide services are in greater demand than ever before in our fifty-year history. This demand, in turn, creates unusual opportunities which attract additional engineering and technical experts to the large McKee staff.

To accommodate our expanded organization McKee added the modern 25,000-square-foot building shown here. Every feature of layout, lighting, air conditioning, sound insulation and efficient equipment was designed with one purpose in mind—to give you better engineering and construction services.

Ideal working conditions contribute to the efficiency of McKee engineers. Private offices and drafting rooms have modern ceiling lighting, air conditioning, floor and ceiling sound insulation and latest engineering equipment.

Arthur G. McKee & Company • Engineers and Contractors
Headquarters: McKee Building • 2300 Chester Avenue • Cleveland 1, Ohio
Offices: New York, N. Y. • Union, New Jersey • Washington, D. C.
British Representatives of Metals Division: Head, Wrightson & Co., Limited
Canada: Arthur G. McKee & Company of Canada, Ltd., 372 Bay St., Toronto

McKee
ENGINEERING & CONSTRUCTION
Services

ager over a newly created sales district in the Texas Panhandle. Headquartering at Amarillo, Patterson will be responsible for city sales at Amarillo and stores located at Farmington, Pampa, and Borger.

J. B. PATTERSON

B. C. PROWELL

Continental Supply stores at Wichita Falls, Nocona and Sherman have been reassigned to the Oklahoma-Kansas division, under the direction of R. A. Brewer, division manager. Jack E. Gallian, district manager located at Wichita Falls, will enlarge his district to include Continental's Ardmore, Okla., sales office and supply stores located at Duncan and Healdton, Okla. The Oklahoma-Kansas division headquarters are in Tulsa.

Rocky Mountain division headquarters will move to a new location and two new sales districts will be added to this division. G. R. Pike, division manager, will have new headquarters at Denver, Colo. B. C. Prowell will be district manager for the newly created district located at Casper, Wyo. J. A. Vogle, formerly area supervisor in West Kansas, will take over the new district headquarters at Billings, Mont.

Other appointments include Rudd Seim as district manager for the tri-state area with headquarters at Evansville, Ind. Noble D. Lane will be district manager for the new district office at Lafayette, La. J. R. Osteen will become district manager at the Corpus Christi, Tex., district headquarters.

J. A. VOGLE

J. R. OSTEEN

A SUPERIOR SWEETENING REAGENT IN PETROLEUM REFINING

CUPRIC CHLORIDE DI-HYDRATE

TC

CUPRIC CHLORIDE

MADE FROM VIRGIN COPPER FROM OUR OWN MINES

PRODUCED BY THE

TENNESSEE CORPORATION

MINERS OF COPPER, ZINC, IRON AND SULPHUR

We are in a position to supply your needs on annual, semi-annual or monthly contract basis—also smaller quantities in drop shipment lots.

CHECK THESE FEATURES

High Copper Content
Lower Moisture
Uniform Particle Size
Uniformity
Availability

For
1. Quality Improvement
2. Cost Reduction

TYPICAL ANALYSIS

Copper	37.00% minimum
Moisture	12.00% maximum
Fe	.04% maximum
Zn	.01% maximum
Copper Oxychloride—less than	.50% maximum

For samples make request on your company letterhead.

Other Tennessee Corporation products: Ferric Sulfate (Ferri-Floc), Copper Sulfate and Sulfur Dioxide.

TENNESSEE TC CORPORATION

617-620 Grant Building, Atlanta, Ga.

Ideco Promotes Shiels To Vice President

E. H. SHIELS

The promotion of E. F. (Gene) Shiels to vice president of Ideco, one of the Dresser Industries, Dallas, Tex., has been announced by George W. Walton, executive vice president of Ideco. Prior to his recent appointment Shiels was domestic sales manager of Ideco and in his new capacity will continue to direct the company's sales activities through branch offices and distributorships in various oil areas of North America.

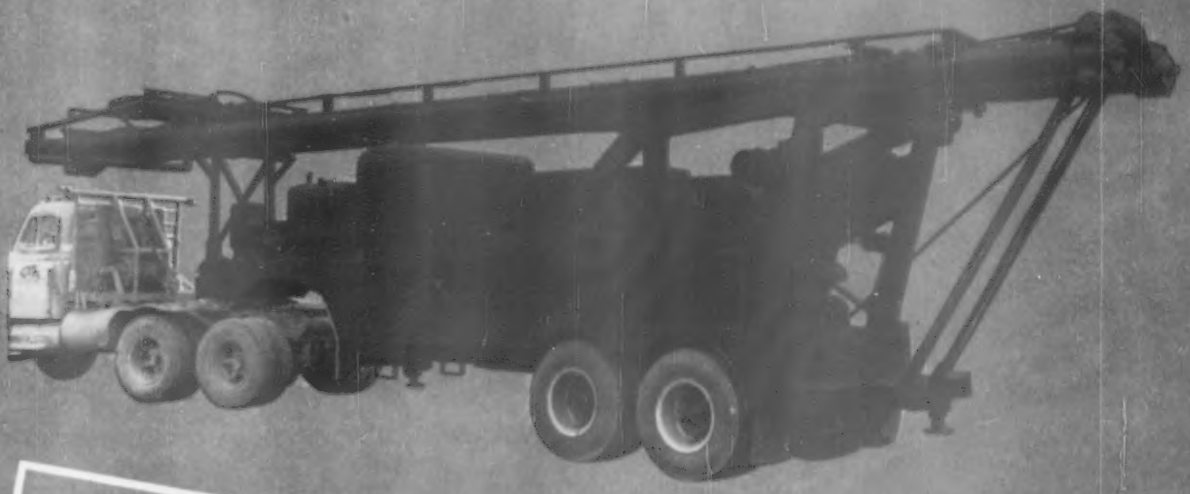
Shiels' career with Ideco began in 1945 when he became sales engineer for oil-field equipment. Within 3 years he was appointed manager of Ideco's newly formed technical service department and in 1951 became domestic sales manager.

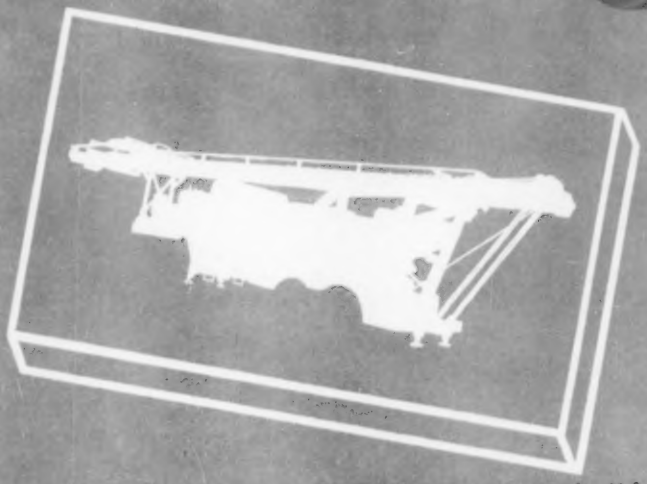
Oilwell Announces Central Midwest Appointments

Transfer of Kennon W. Chambers, field reresentative, from Shreveport, La., to Kilgore, Tex., for U. S. Steel Corp.'s Oil Well Supply Division and appointment of Charles D. Parks and Bobby F. Kelier as field representatives at Shreveport and Hobbs, N. M., have been announced by William Mis-

CUSTOM DESIGNED

for Cost Conscious Operators





WORKOVER UNITS

DRILLING UNITS

SPUDDERS

SPECIAL UNITS

COOPER builds the right machine. Trailer, Self-propelled or Skid units, to properly handle your Rotary Workover jobs, Cable Tool clean-out work and Rotary Drilling to medium depths. Custom designing of these units assures high portability, rugged construction, easy operation and maintenance. These Cooper Units can be powered with either gas or diesel engines.

Above: Cooper Model A42-36 tandem walking axle trailer-rig with 190 h.p. gas engine for drilling to 4,000 ft., workover to 10,000 ft.

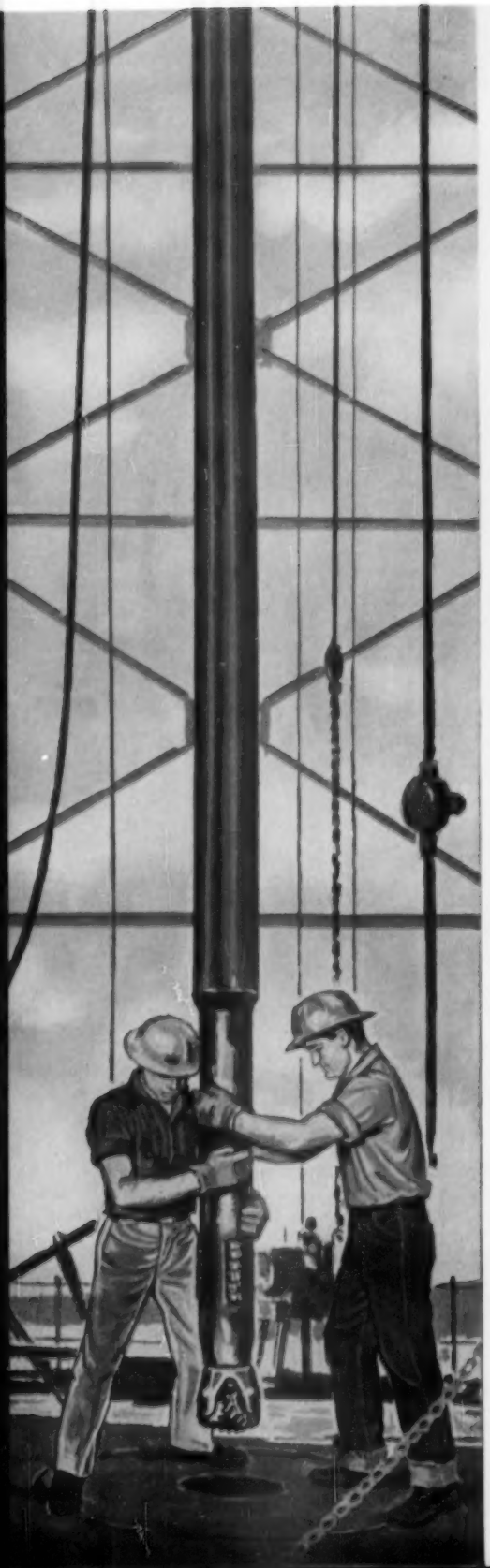
Write for complete specifications or ask a Cooper representative.

Originator of Mobile Winch Units

FRED E. Cooper, Inc.

P. O. BOX 1890 TULSA, OKLA.

Branches: Houston, Odessa, Los Angeles, Cincy



New drilling

Longer bit life . .

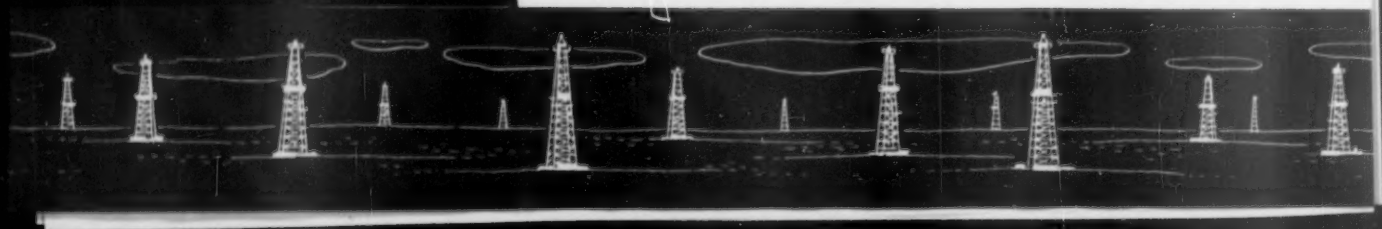
The emulsifier creates and maintains an oil film on the bearings and drill pipe, increasing bearing life, providing substantial corrosion protection, and permitting increased weight on the bit. Viscosity build-up and weight increases from shales are eliminated, as low specific gravity solids are dropped out.

Fewer bits required

In over 20 wells drilled with this emulsifier in the Permian Basin, the following observations were made:

Penetration rates and bit life were remarkably increased. An average of only 26 bits were used, as compared with 45 bits with water and water base muds. Cuttings size was improved. Torque was greatly reduced. A better and safer hole was made. Additional information and case histories are presented in The Oil and Gas Journal for Aug. 13, 1956. Read "New Oil Emulsion Speeds West Texas Drilling" by Ed McGhee.

Look for this seal ▸ ▸



fluid emulsifier

. higher bit weights

★ Increased Penetration Rates
★ Reduced Torque
★ Increased Cuttings Size
★ Longer Bit Life
★ Reduced Corrosion
★ Easier Mud Control

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DRILLING MUD SERVICE

Drilling Milk

These leading mud companies market the new high speed drilling fluid under their own labels. They will supply you with information on the application and use of these materials. Their extensive distributor and service organizations make them readily available.

The Aquaness Seal on each drum of the new high speed drilling fluid emulsifier is your assurance of a top performing product . . . created and manufactured by Aquaness, thoroughly field tested by a leading drilling contractor.

For further information write to Macco about their LUMUL, Baroid about their TRIMULSO or Magcobar about their Drilling Milk, or call your local distributor of these companies.

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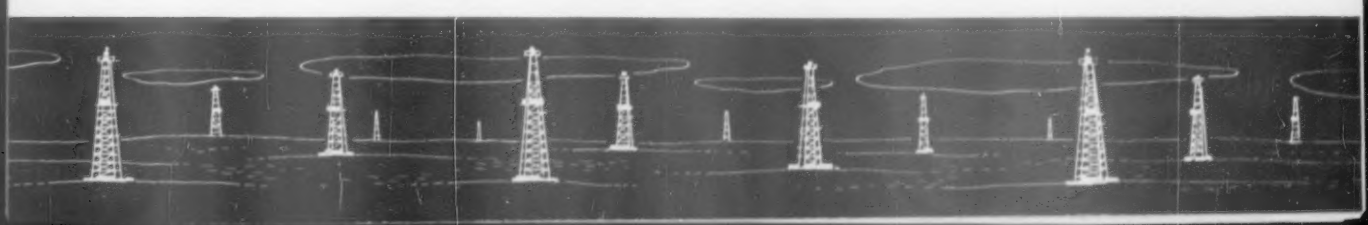
The Aquaness Seal is your assurance of uniform, top quality products.



THE MEN WHO KNOW...

...WHY WmSON EQUIPMENT IS SPECIFIED

"BEST SPACER I'VE SEEN"
Says A. B. Bryant (right) examining a WmSON THINSULATOR with F. E. Zongker of T. D. Williamson, Inc.*

INSTALLING "Z" BUSHING ON 30" PIPE AND 34" CASING

AMERICAN LOUISIANA PIPE LINE CO.

Selected WmSON Casing Seals and Pipeline Insulators to meet their exacting requirements for 1,025 right-of-way crossings between North Tepepate, La. and Detroit, Mich.

*Pipeline Inspector for FORD, BACON & DAVIS, INC.
(Engineers for AMERICAN LOUISIANA PIPE LINE COMPANY)

T. D. Williamson, Inc.
P. O. BOX 4038 TULSA 9, OKLAHOMA
REPRESENTATIVES: HOUSTON • PITTSBURGH • PLAINFIELD, N. J. • AMARILLO • JOLIET, ILLINOIS • LOS ANGELES • SAN FRANCISCO • BARTLESVILLE, OKLA. • SEATTLE • EDMONTON, LONDON, ONT. • CALGARY • VANCOUVER, B. C. • BUENOS AIRES • CABIMAS, ZULIA, VENEZUELA • DURBAN, NATAL, SOUTH AFRICA • PARIS, FRANCE

kimins, the division's Central Midwest area manager.

Chambers was employed by Oilwell in 1952 at Greggton, Tex. Parks joined Oilwell in 1951 at El Dorado, Ark., where he was employed prior to his present appointment. Kelier was employed in June 1956 at the Hobbs store. Prior to joining Oilwell, he had 8 years' oil-field sales and service experience.

Vinson Supply Names Gulf Coast Manager

HEINZERLING

John H. Heinzerling has been elected a member of the board of directors of Vinson Supply Co. and appointed manager of Vinson activities in the Gulf Coast area, with headquarters in Houston. The announcement was made by Baile W. Vinson, chairman, and J. M. McReynolds, president of Vinson Supply.

In making the announcement, Vinson and McReynolds pointed out that Vinson is stepping up its Gulf Coast activities with the construction of a 152,000-sq.-ft. warehouse plus a 10,000-sq.-ft. office building. Although the company has had a sales office in Houston for 2 years, the company is now, for the first time, stocking large quantities of National tubular goods, Nordstrom plug valves, Crane valves, and Ladish welding fittings and flanges.

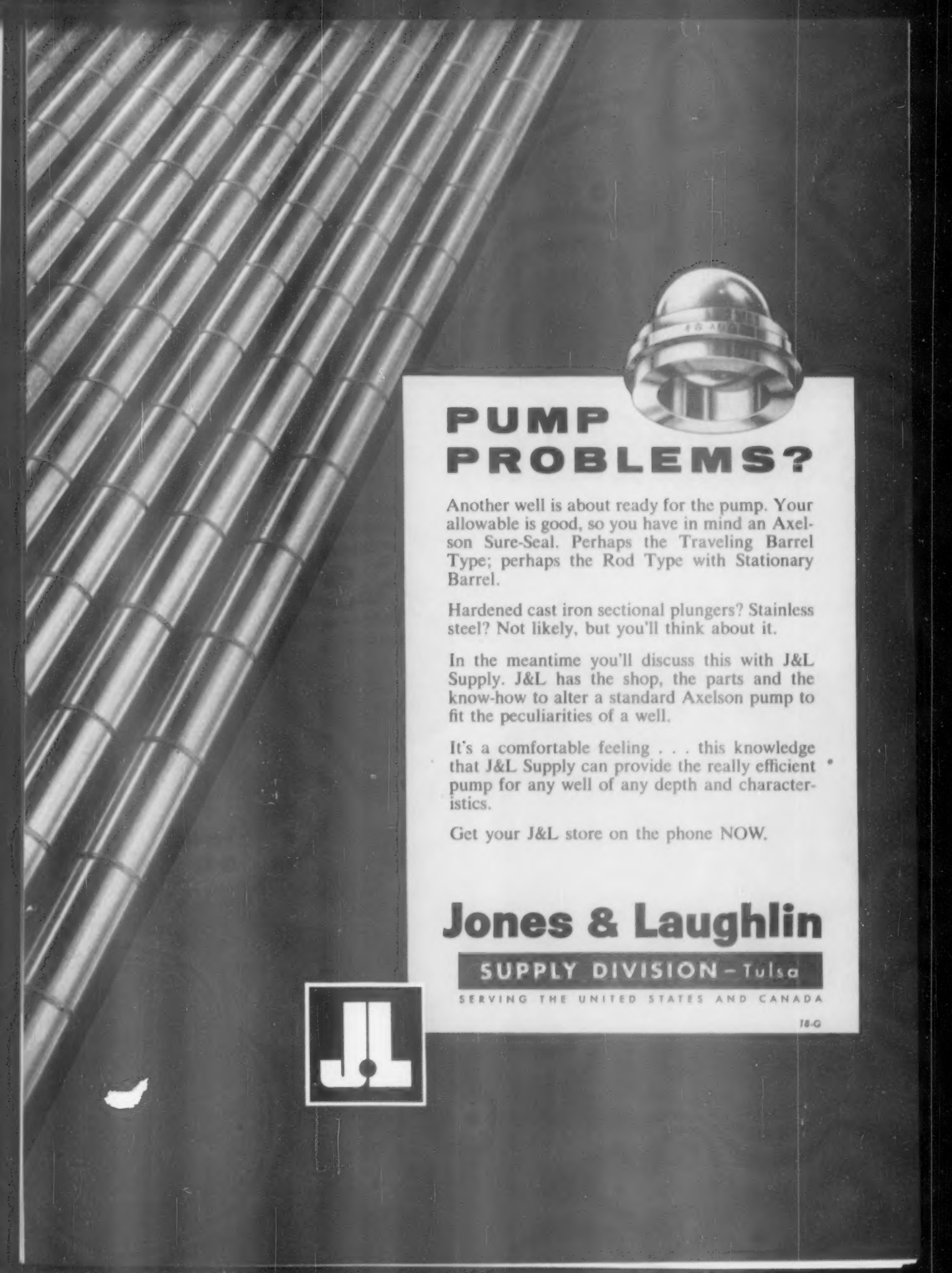
Heinzerling joined Vinson in 1941. In 1951 he was elected a vice president and continued in Tulsa until 1954 when he went to Houston to open a sales office and to initiate Vinson activities in the Gulf Coast area.

Division, District Posts Filled by Schlumberger

Wilbur D. Ford is the new Kansas division sales manager at Wichita, Kans., for Schlumberger Well Surveying Corp.; L. D. Thomas has been named manager of Schlumberger's district office at Duncan, Okla.; H. F.

W. D. FORD

L. D. THOMAS



PUMP PROBLEMS?

Another well is about ready for the pump. Your allowable is good, so you have in mind an Axelson Sure-Seal. Perhaps the Traveling Barrel Type; perhaps the Rod Type with Stationary Barrel.

Hardened cast iron sectional plungers? Stainless steel? Not likely, but you'll think about it.

In the meantime you'll discuss this with J&L Supply. J&L has the shop, the parts and the know-how to alter a standard Axelson pump to fit the peculiarities of a well.

It's a comfortable feeling . . . this knowledge that J&L Supply can provide the really efficient pump for any well of any depth and characteristics.

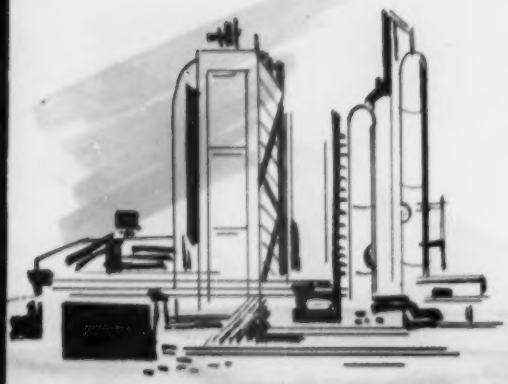
Get your J&L store on the phone NOW.

Jones & Laughlin

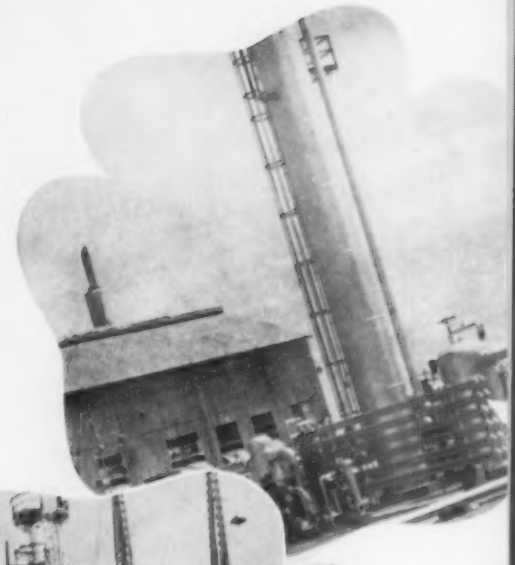
SUPPLY DIVISION – Tulsa

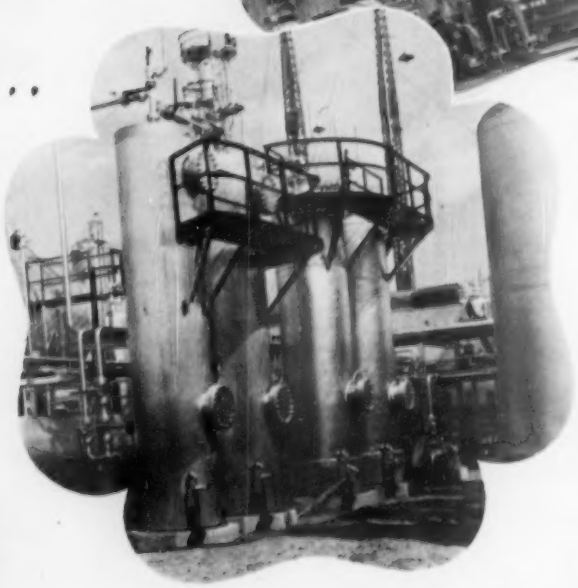
SERVING THE UNITED STATES AND CANADA

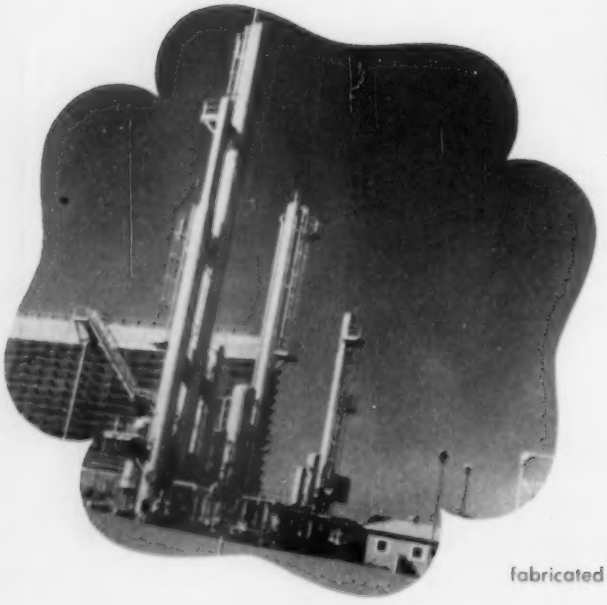
18-G



Signs of Quality...







Pictured above are three major installations fabricated by McNamar Boiler and Tank Company.

McNamar's quality products are designed for low maintenance operation, easy upkeep and are built to withstand years of rugged use.

Call, write or wire McNamar for further information concerning your individual needs.

McNAMAR BOILER & TANK COMPANY

Box 868 • Phone CHerry 2-6291

Tulsa, OKLAHOMA

Sorensen becomes division sales manager at Fort Morgan, Colo.; Noble Ellis has been promoted to field sales engineer at Lafayette, La. The new field sales engineer at Roswell, N. M., is Robert S. Beaty.

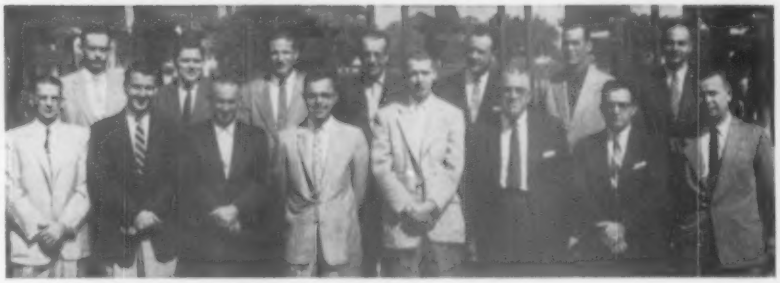
Ford previously served the Mid-Continent area at Wichita, Russell, and Ardmore. Thomas joined Schlumberger in 1950. Sorenson was formerly Schlumberger district manager at Sterling, Colo. Ellis and Beaty joined the company in 1950. Beaty has served as field engineer in several locations.

B&W Names Hammond Mgr. Of Welding Fittings Sales

M. A. HAMMOND

Millard A. Hammond has been named manager of welding fittings sales of Babcock & Wilcox Co., tubular products division, it has been announced by James S. Anderson, general sales manager of the division. Formerly in charge of fittings sales in the division's Philadelphia district, Hammond will be responsible for sales of the product through the 15 district sales offices throughout the United States and four foreign sales representatives of the division. His headquarters will be at the division's Milwaukee plant.

Hammond formerly served as sales engineer for The Trane Co. and Taylor Forge & Pipe Works. Before joining B&W in 1956 he was sales manager, Buckeye Forging Co. of Cleveland.



Alten Holds Fall Sales Conference

The sales and field personnel of Alten Foundry & Machine Works assembled recently for Alten's annual sales roundup. Business sessions, including showings of newest Alten pumping-unit models and disclosures of promotion plans for the coming year, were conducted by Warren M. Benson, vice president and sales manager. Round-table marketing and selling discussions were led by Stanley Zybura of Research Institute of America and W. D. Schaffner, Merchandising, Inc., Newark, Ohio.

Pictured in the first row: Doyle Gardner, Lancaster sales office; William Morris, assistant chief engineer; Lloyd Morgan, Gulf Coast territory; Charles Kessinger, Rocky Mountain territory; Warren M. Benson, vice president; R. R. Matthews, division sales manager at Tulsa; Don Griggs, eastern territory; Fred R. Bayne, chief engineer.

Back row: Earl F. Brooks, manager, sales office; R. M. McCauley, sales office; F. F. Hunt, Kansas territory; Lon Belcher, Oklahoma territory; S. W. Collins, Indiana-Illinois territory; William Hudson, North Texas territory; Roy Longnecker, sales promotion manager.

Lane-Wells Makes Location And Personnel Changes

Lane-Wells Co. has opened a truck station in Artesia, N. M. The Okmulgee, Okla., station has been closed and its activities transferred to Seminole.

T. W. Lindsey has been transferred

What the WELL-DRESSED, MEDIUM-PRESSURE Wells are wearing

This well is equipped with the compact "Tee Base Type" HERCULES Duplex Stuffing Box and HERCULES "Type SO" Tubing Head. The Tubing Head is equipped with HERCULES original overhead packing arrangement and self-aligning hinged slips, making this a simple yet complete hook-up, featuring safety with simplicity and minimum of parts.

AVAILABLE THROUGH ALL SUPPLY STORES

If you have any problems involving well head equipment, a phone call, telegram or letter will bring you the desired information — quick.

HERCULES TOOL Company

MANUFACTURERS OF OIL FIELD EQUIPMENT SINCE 1924

GENERAL OFFICES AND PLANT TULSA, OKLAHOMA

Export Representative: Oil Field Equipment Co., Inc., 30 Church Street, New York 7, N. Y.

THE CHEMICAL PROCESS CO.
SERVICING
OIL & GAS
WELLS
Acidizing Services: CPC J-Type Acid, Mud-Sol, CPC Gelled Acids. Fracturing Services: Geofrac-5 and -15, Gelled Oilfrac, CPC Gelled Water, T-O, Adomite. Water Block and Emulsion Block Removal Services: Restoroil, CPN, Atpet. Formation Blocking Materials: Formjel, Thermogel, Firmjel. Permeter Services: Permeability Surveys, Controlled Acid Treatments, Open-Hole Caliper Surveys. Visqueez Service for cementing off formation water.
THE CHEMICAL PROCESS CO.
General Offices and Laboratory, Breckenridge, Texas
Stations Throughout the Mid-Continent Area

from Hobbs, N. M., to Houston as area manager. M. P. Mathew, formerly with Lane-Wells Canadian company, replaces Lindsey at Hobbs.

Don Norden has been named district logging and mechanical engineer at Farmington, N. M., replacing Jesse Smith, who transferred to the division logging department at Oklahoma City.

John L. Morton has been transferred from Kimball, Neb., to Riverton, Wyo., as station manager. Wayne E. Campbell has been transferred from Sterling, Colo., to Kimball as field service operating engineer in charge.

Win-Well Names Gulf Coast Sales Representative

C. C. Pryor has been appointed Gulf Coast sales representative for Win-Well Manufacturing Co. of Los Angeles.

Previous to the opening of his own manufacturer's representative firm, Pryor was associate editor of both Petroleum Engineer and Petroleum Refiner. He had also been associated with Brown Instrument Co., W-K-M Co., and A-1 Bit & Tool Co.

Houston Nomads Host to Venezuelan Superintendents

Two district superintendents from Venezuela were guests of Houston Nomads at their October meeting: G. W. Von Hillo (left) with Shell Oil of Venezuela, and J. W. White (right), district superintendent, Sinclair Oil & Gas Co. of Venezuela.

Robert K. Franklin, president of Rolo Manufacturing Co. and chairman of the National Board of Regents of the National Oil Equipment Manufacturers and Delegates Society, gave the principal address. He outlined his trip to South America, indicating that more interest is being shown by oil companies in Nomad activities.

Three new Nomads were inducted into the chapter, filling the membership quota. They were Ted Fullinwider, domestic oil-field sales manager, Mission Manufacturing Co.; Sam Pearce, Camco, Inc.; and Raleigh Hortenstine of Continental Supply Co.

LEE C. MOORE
TRAILER MOUNTED MASTS

. . . mast stems directly over operating loads

NO GUY LINES!

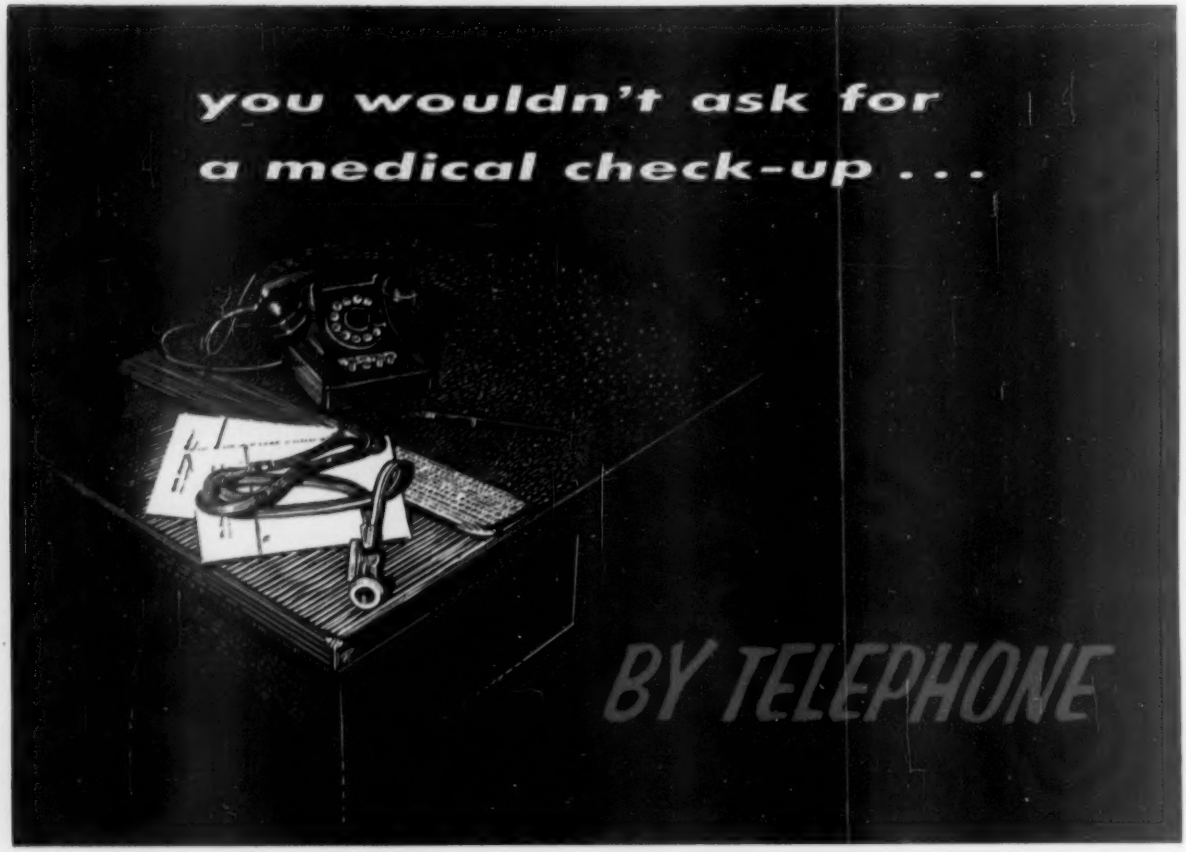
This self-supporting mast is the result of long experience in engineering design. Elimination of guy lines is another important reason why Lee C. Moore trailer mounted masts provide greatest possible speed in moving and assembly.

LEE C. Moore CORPORATION

TULSA : SHREVEPORT : GREAT BEND : CASPER : NEW ORLEANS
CENTRALIA : DALLAS : HOUSTON : MIDLAND : PITTSBURGH
EXPORT OFFICE:—ROOM 624, INTERNATIONAL BLDG., 630 5TH AVE., NEW YORK 20, NEW YORK
FOREIGN LICENSED MFR. OIL WELL ENGINEERING CO., LTD., CHEADLE HEATH, STOCKPORT, ENGLAND

- **SINGLE TRAILER MOUNTED MASTS** 86 ft. 94 ft. 97 ft. 97 ft. Heavy duty 100 ft. 126 ft. Export model
- **DUAL TRAILER MOUNTED MAST** 97 ft. 100 ft. 126 ft. 126 ft. Export model

you wouldn't ask for a medical check-up . . .



As scientific as our modern system of communications is, it has certain limitations. For example, a medical check-up by telephone would be a risky substitute for a direct physical examination in the doctor's office.

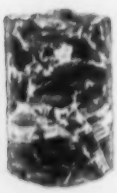
Each formation evaluation technique has its proper time and place, too.

For example, tangible "down-to-earth" reservoir information starts with a direct surface analysis of the basic product — the formation and its contents. Then, from these virgin data which accurately determine the physical make-up and productive potentialities of the formation, the proper choice and effective application of various types of down-hole electronical and mechanical tests can be made.

The results of every geologically significant well deserves a straightforward evaluation. There are many excellent devices for indicating "symptoms," but there is only one completely dependable method of measuring the "cause"—*coring and core analysis.*

Of our twenty-two integrated reservoir engineering services, there is one which will perfectly fit your core analysis requirements. Call the Core Lab man nearest you.

THE ONLY FULLY INTEGRATED PETROLEUM RESERVOIR ENGINEERING FIRM



CORE LABORATORIES, INC.

801 CORE STREET, DALLAS, TEXAS

CORE LAB
PETROLEUM RESERVOIR ENGINEERING

DALLAS, FT. WORTH, HOUSTON, CORPUS CHRISTI, McALLEN, SAN ANTONIO, MIDLAND, ABILENE, PAMPA, MONAHANS, LUBBOCK, LOVINGTON, SHREVEPORT, TYLER, EL DORADO, OKLAHOMA CITY, WICHITA FALLS, TULSA, ARDMORE, BARTLESVILLE, LIBERAL, ARKANSAS CITY, GREAT BEND, LAFAYETTE, NEW ORLEANS, HATTIESBURG, DENVER, STERLING, CASPER, WORLAND, KIMBALL, NEBR., FARMINGTON, BAKERSFIELD, LONG BEACH, CALGARY, EDMONTON, REGINA, VENEZUELA, S. A.

Optimism Pervades Williston Meet

"Much additional oil will be found in the Williston basin in the future. The basin has settled down to a period of steady development . . . Everyone agrees that Williston hasn't even been scratched, and that what the basin needs is wildcats—lots of them."

by John C. McCaslin

THE consensus of nearly 400 geologists who gathered in Bismarck last month for the first international Williston basin geological symposium is that the ripple of discouragement filtering through the United States side of the basin is unreasonable. They agree that outside the southeastern Saskatchewan area, where a Mississippian oil giant is building up, the basin has settled down from its initial oil fever to steady development. Despite the fact that the United States side of the basin has had only one important oil find this year (Antelope), Williston geologists still consider the region one of the best undeveloped sedimentary basins in North America in which to hunt for oil and gas. Why? Let's look at the record and see how it applies to Williston's future course in exploration.

A backward glance . . . Plenty of oil history has been written in the Williston basin in the past 6 years. Following Beaver Lodge and Poplar, the oil hunters swarmed into the Nesson anticline and eastern Montana country. Here oil prospects that had everything —structure, source rocks, reservoir rocks, and most important, oil. Three years later wildcats became as scarce as pine forests on the Montana plains. Then the wildcat drill began probing the unknown in the deep central portion of the basin between the Cedar Creek and Nesson anticlines. A few discoveries and a wealth of geological information were uncovered in this campaign. Then this flurry died down.

Foyer comments at the symposium ranged from "but look at the dry holes we've been getting—57 of them this year in North Dakota" to "but don't forget that as of June this year 1,408,865,862 bbl. of oil have come out of Williston fields (107 of them)". Everyone agreed that the Williston basin isn't even scratched. This is the sound type of exploratory thinking that uncovers new oil provinces.

One of the outstanding papers at the meeting pointed out that the basin now is in a competitive position with the continent's other oil and gas provinces. Drilling costs have become favorable with other basins of similar depth factors. Drilling problems have been reduced considerably. Oil marketing has greatly improved since 1952. Payoff on investment is varying from 3 for 1 to as high as 8 for 1.

The enthusiastic crowd at the symposium was the Canadian group. And enthusiastic they should be. The basin's biggest drilling play since the old Beaver Lodge days is under way in southeastern Saskatchewan. Exploratory drilling after discovery of Alida field has uncovered similar fields and proved reserves totaling nearly 100,000,000 bbl. The success ratio of southeastern Saskatchewan drilling is one in four, second only to the Hugoton embayment and South Louisiana. With the exception of Pembina, the Alida area is the busiest in Canada, and will become even busier in the coming months. Lease expirations in many areas next year force fast development. Pipeline outlets are assuring crude transportation. Producing depths and drilling costs are reasonable.

Sires future paths . . . One general comment at the symposium was that much additional oil will be found in the Williston basin as a result of the present steady development program and lessons learned in 6 years of drilling. Based on the past here are some guideposts for the future in the Williston basin:

. . . One important signal for the future in the basin is the need of increased use of geological and geophysical techniques as well as plain backyard geological studies. The straight geological studies are of the utmost importance in the search for stratigraphic traps which are present on the basin's east side. Much drilling will be needed to find these traps, and the place to look for them is in eastern North and South Dakota.

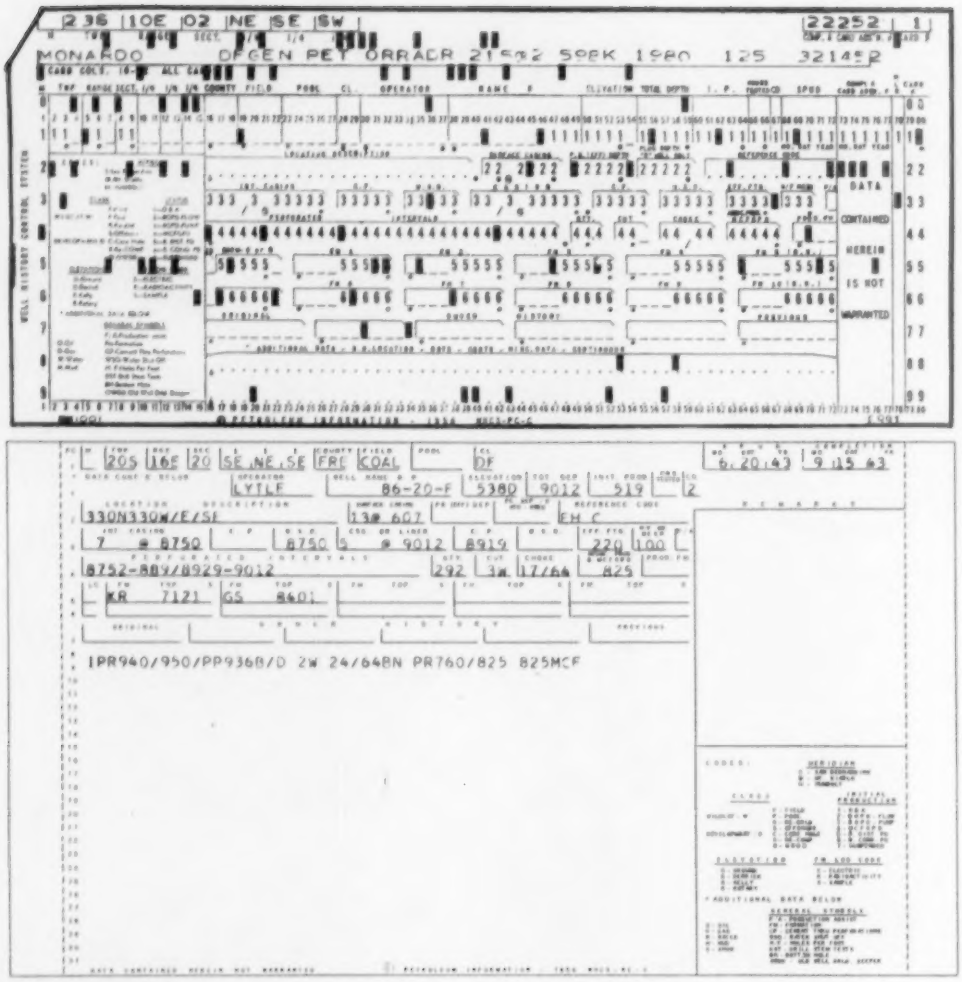
. . . Despite the disappointment in eastside Williston exploration on the United States side in the past 3 years, this area should be more fully explored. What the east needs is wildcats—lots of them.

. . . It appears that the best oil prospects in the basin are in the areas underlain by the Mississippian and Cretaceous. But what about the rocks on down the geologic column? Rocks in the basin go clear through Cambrian. Let's not overlook the possibilities of the older section in the basin, particularly the Ordovician. Two very important papers presented at the meeting stated the need for inspection of the Winnipeg and older rocks in the Williston basin. The Winnipeg sand, which lies at the base of the Winnipeg formation, has excellent porosity and permeability, and should be considered a possible future oil reservoir.

. . . The adoption of a basic system of Mississippian nomenclature in the International Boundary area would facilitate subsurface information interchange. A correlation system that is regionally applicable is necessary for international cooperation, avoiding the use of local, geographic, or company designations.

. . . The seismograph does furnish data on many geologic conditions often called "not suited". Such data can be made useful by sincere collaboration of the seismologist and geologist.

. . . More regional meetings of Williston geologists are needed for the interchange of new ideas, problems, and lessons learned.



Card No. 1 in each well-history sequence is shown (card at top). The operator punches data into each card "field" as indicated by the titles. Positive location and card association control is obtained by automatic duplication of location and completion date. Bottom card is the direct-read card.

by
W. T. Smith
California
District Editor

CALIFORNIA SCORES A FIRST AS . . .

Punch Cards Are Designed for

CALIFORNIA operators will shortly have available to them the first complete punch-card well-history control system in the industry.

This ambitious task of designing and installing the system, where virtually every detail on every well drilled in the state is put on punch cards, is the brainchild of the aggressive Goodin brothers, Bill, Maury, George, and Ed, of Petroleum Information, Denver.

The application of well completion and history data to electronic processing equipment is not new in itself, but it has never been attempted on the scale of the system P.I. is installing in California. Estimates are that before the system is brought up to current drilling, it will include more than 400,000 cards on some 75,000 wells.

Petroleum Information's punch-card well-data system is designed to not only make information more readily available from a single source, but to also make it more usable. With that thought in mind Ed Goodin, of P.I., and Frank Benz, of International Business Machine Corp.'s Los Angeles office, came up with a system which utilizes a card with 80 vertical columns 12 rows deep.

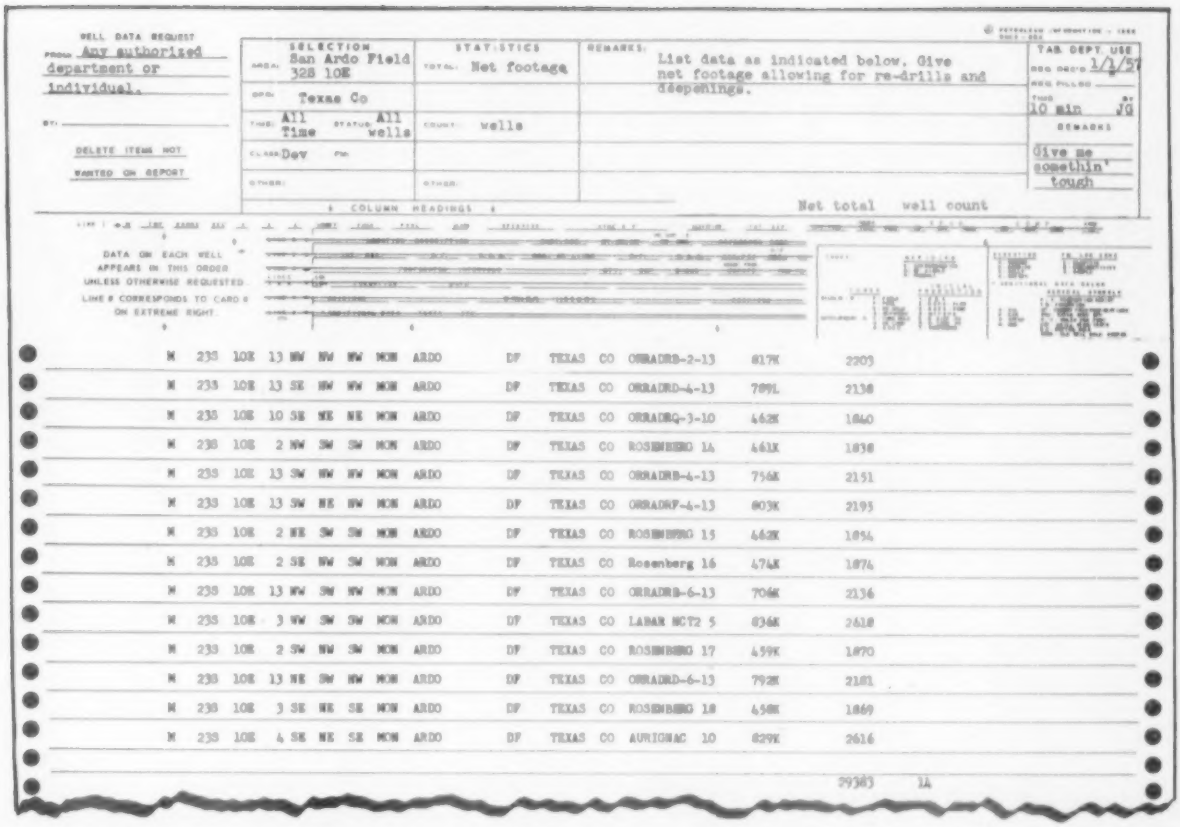
Ed Goodin characterizes P.I.'s system as "a three-dimensional punch-card system in which well-completion data are deposited in card lamination, always associated together, and always in proper sequence.

"Machine processing then permits the search for, finding, calculation, and printing in the relationship desired.

"The system acts as a permanent storage vault of data to which creative and interpretive talents of the oil-company users may deposit and withdraw at will, releasing valuable employes from the burden of digging through mountains of files," Goodin explains.

The system . . . When a well is ready to be integrated into the system the completion data are punched onto as many different cards as necessary, depending on how much dope is available. Based on experience thus far, the average California well will require 4.6 cards, with 16 being the probable maximum number necessary on a complicated well.

Card No. 1 includes location data (down to 10-acre spacing), operator's name, well number, location, total



WELL DATA REQUEST

From: Any authorized department or individual.

By:

DELETE ITEMS NOT WANTED ON REPORT

SELECTION: Area: San Ardo Field 32S 10E; Oper.: Texas Co; Time: All Time; Status: All wells; Class: Dev; Other:

STATISTICS: Total: Net footage; Count: wells; Other:

REMARKS: List data as indicated below. Give net footage allowing for re-drills and deepenings.

TAB DEPT USE: Req. Date: 1/1/57; Req. Filled:; Time: 10 min; By: JG; Remarks: Give me somethin' tough

↓ COLUMN HEADINGS ↓

Net total well count

DATA ON EACH WELL APPEARS IN THIS ORDER UNLESS OTHERWISE REQUESTED. LINE 8 CORRESPONDS TO CARD 8 ON EXTREME RIGHT.

	M	23S	10E	13	NW	NW	NW	MDM	ARDO		DF	TEXAS	CO	ORRADRB-2-13	817N	2203
	M	23S	10E	13	SE	NW	NW	MDM	ARDO		DF	TEXAS	CO	ORRADRD-4-13	789L	2138
	M	23S	10E	10	SE	NE	NE	MDM	ARDO		DF	TEXAS	CO	ORRADRQ-3-10	462K	1840
	M	23S	10E	2	NW	SW	SW	MDM	ARDO		DF	TEXAS	CO	ROSENBERG 1A	461K	1838
	M	23S	10E	13	SW	NW	NW	MDM	ARDO		DF	TEXAS	CO	ORRADRB-4-13	756K	2151
	M	23S	10E	13	SW	NE	NW	MDM	ARDO		DF	TEXAS	CO	ORRADRF-4-13	803K	2195
	M	23S	10E	2	NE	SW	SW	MDM	ARDO		DF	TEXAS	CO	ROSENBERG 15	462K	1854
	M	23S	10E	2	SE	NW	SW	MDM	ARDO		DF	TEXAS	CO	Rosenberg 16	474K	1874
	M	23S	10E	13	NW	SW	NW	MDM	ARDO		DF	TEXAS	CO	ORRADRB-6-13	706K	2136
	M	23S	10E	3	NW	SW	SW	MDM	ARDO		DF	TEXAS	CO	LABAR NCT2 5	834K	2618
	M	23S	10E	2	SW	NW	SW	MDM	ARDO		DF	TEXAS	CO	ROSENBERG 17	459K	1870
	M	23S	10E	13	NE	SW	NW	MDM	ARDO		DF	TEXAS	CO	ORRADRD-6-13	792K	2181
	M	23S	10E	3	SE	NE	SE	MDM	ARDO		DF	TEXAS	CO	ROSENBERG 18	456K	1869
	M	23S	10E	4	SE	NE	SE	MDM	ARDO		DF	TEXAS	CO	AURIGNAC 10	829K	2616
															29383	14

In this illustration the I.B.M. machine was asked to search for The Texas Co. development wells. On finding, it was to print only certain data out of card No. 1 At the same time it was to obtain the net footage of the deepened well by subtracting the old total depth. It was then to do the same thing on the redrill by subtracting whipstock point from total depth. It was then to list these net footages alongside the well concerned . . . then total all and count the number of wells.

New California Reports Start This Week

On Friday, November 9, Petroleum Information launched a Pacific Coast-Intermountain data reporting service similar to its 28-year-old reporting service in the Rocky Mountains.

The new service conforms to the regular P.I. publication program—complete detail data Friday, and the wildcat picture Tuesday and special bulletins on spot news of importance.

Reports on Oil Wells

depth, field or wildcat well, producing depth if applicable, spud date, completion date, initial production, flowing or pumping, and whether it is an oil, gas, distillate, or condensate well.

Card No. 2 information includes spaces for location footage, two casing sizes, plug back, redrill, or whipstock depths and a space for a company-designated reference code. This reference code column will indicate what additional well history data such as logs, reports, core analysis, etc., are available in the company files on that particular well.

Card No. 3 has allotments for two additional pieces of casing data, two spaces for cement perforation points, two WSO points, how much formation is open, holes per foot in perforated pipe or liner mesh size, and a column for an Alpha code system designating production assists used such as fracturing, acidizing, etc.

Card No. 4 data include perforated intervals, oil gravity, cut, type of cut, choke, and any associated production such as gas M.c.f.

Cards Nos. 5 and 6 have prepositioned spaces for formations encountered in the well plus a place for a coded column on shows encountered during drilling.

Card No. 7 has spaces for six prepositioned ownership listings beginning with original owner and carrying through to current owner.

Card No. 8 is blank in P.I.'s system. It is reserved for the individual company's use for such additional information as it might chose to put in at that point.

Card No. 9 is the first miscellaneous data card. It can be used to include drill-stem-test data, bottom-hole locations, contractor's cores, etc.

Cards can be added to the system beyond this point as many times as the system owner wants and has information to go on them.

In addition to card sets on original completions, the P.I. system includes a separate set of cards on redrill jobs, deepening jobs and re-completions where such work involves completion in a new zone. These categories are

the precise position. . . . of the X that marks the spot is fixed by a Decca Mobile Chain with a speed and certainty unobtainable by any other means. Providing wide-area coverage under all weather conditions Decca Mobile Chains have been proved in the field to be the most efficient and flexible of all electronic position fixing systems. In a single season the saving in time and manpower achieved by a Decca Mobile Chain can fully cover its initial cost.

Precise position fixing with low ambiguity and true repeatability over long or short periods.
Ease of operation.
Built-in electronic referencing, eliminating "reference buoys".
Decca operates irrespective of height or terrain—the same Chain can be used by ships, aircraft, vehicles or ground parties.
Automatic and continuous map display of track and position with the Decca "Track Plotter".

THE DECCA NAVIGATOR

Mobile Chains for Survey and Exploration

THE DECCA NAVIGATOR COMPANY, LTD., LONDON, ENGLAND

Here's a part of the large battery of punch-card equipment.

particularly applicable to California where such work has become increasingly important in recent years.

Cards are kept in files by location on a township and range basis.

The system is also set up so that it can be implemented at an individual company level with a second system involving information on company wells. The potentials of this second part, which will be purely a company function and not P.I.'s responsibility, contemplates additional cards on company wells listing such detailed data as bit records, preliminary geophysical data, detailed cement and mud programs, deviation surveys, detailed periodic production data, permeability and porosity data, paleogeological data, and lease and financial-interest data.

Each of these more detailed information cards can be related in sequence to P.I.'s well-history control system.

In addition to the punch cards, the system will include a readable card on each well which is similar in appearance and purpose to a completion card of scout ticket now commonly used.

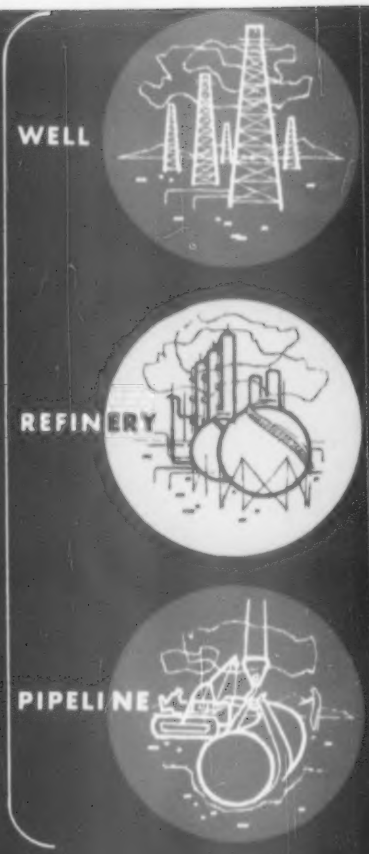
In application of the system, duplicate readable card sets will probably be made for distribution to various departments and field divisions of a company. These readable cards can be easily and economically reproduced as part of the system.

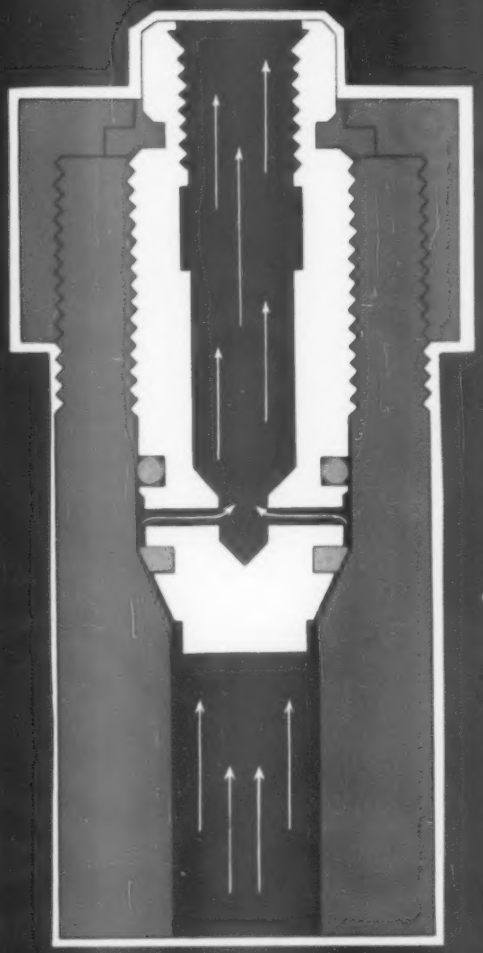
Machines and personnel . . . In order to utilize the system completely outside the assistance available from P.I.'s process equipment, companies will need a card punch, sorter, collator, and a printing machine. P.I. uses a printer capable of 150 lines per minute.

The only specially trained person required for data deposition is a clerk familiar with the key punch machine employed. This clerk can be completely trained to handle this phase of the

for built-in SAFETY

and operating ECONOMY of





the COSASCO "*Access* principle"* PERMITS TAKING ENTRY AT WILL AGAINST PRESSURE...

*Formerly known as the "Scotch Nipple Principle"

be sure

COSASCO *Access*

fittings

are installed ahead of valves and gauges

- to seal off outlets but retain gauging or testing capacity
- to remove or replace valves or other externals
- to insert instruments, coupons, samplers, thermocouples and hydrogen probes without interfering with operation

Design and Applications of COSASCO *Access* Fittings

COSASCO *Access* NIPPLE

The Cosasco nipple, illustrated in cutaway and with plug installed, represents the basic design of all Cosasco Access fittings. Adaptation to other forms can easily be visualized.

The Cosasco nipple differs from standard connectors by having a tapered seat and fine threads machined within it to accommodate a screw-in plug. Externally it has the usual pipe or union assembly threads. In the illustration a safety ring has been run down over the upper (or plugged) end. It is involved when operating the nipple as a valve, and protects the pipe threads.

The Access plug is of low carbon nickel stainless steel. Its only metal-to-metal contact with the body of the nipple is at the fine threads, since diameters elsewhere are less than the inside diameters of the nipple. Contact with the nipple seat is made only by the primary seal, a ring of impervious hydraulic packing. There is a secondary seal or "O" ring in a circumferential slot just below the fine threads. Between these seals, by-pass holes penetrate the plug wall to the interior.

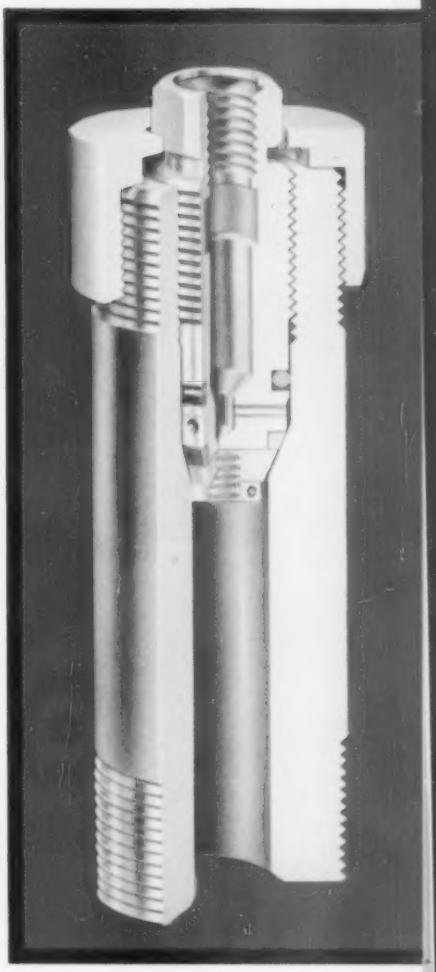
The interior of the plug is open to provide communication from the by-pass holes to the exterior. A recess near the top accommodates removal tools. Within the hexagonal end of the plug there are threads for attaching a pressure gauge or other instrument.

How it functions

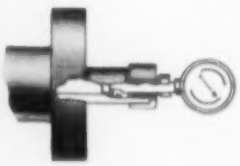
When the plug is turned down so that the primary seal is pressed against the tapered seat, flow of gas or fluid is effectively blocked. Backing out or unscrewing the plug until it shoulders on the safety ring lets gas or fluid under pressure pass the primary seal.

Blocked by the secondary seal or "O" ring, the gas or fluid goes through the by-pass holes into the plug for direct communication with gauge or other external equipment.

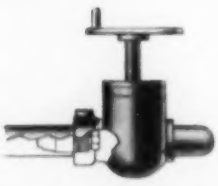
Entry through the Access nipple may be taken at any time with a Cosasco Retriever and full-opening valve, as described on a following page.



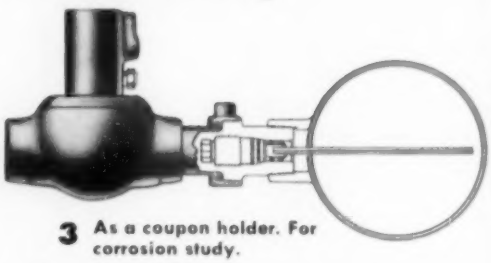
Typical COSASCO *Access* applications



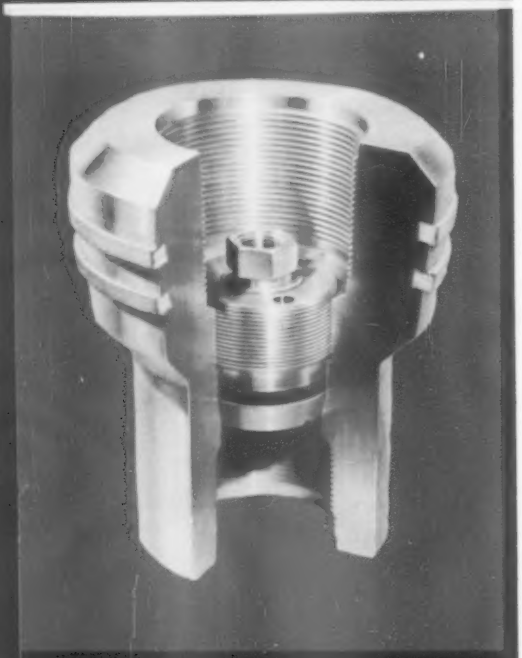
1 As a gauge valve. With plug installed.



2 As a flow nipple. With thread and seat protector installed.



3 As a coupon holder. For corrosion study.



COSASCO *Access*

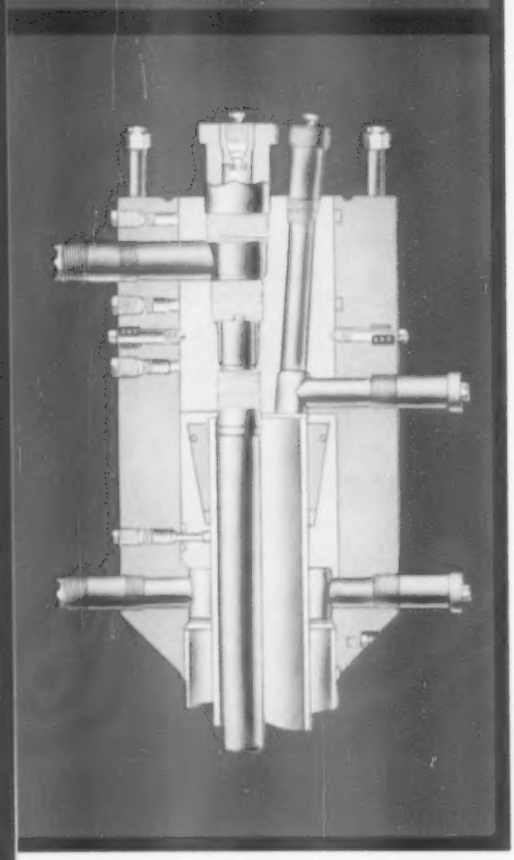
Tubing Suspension MANDRELS

One of the most valuable adaptations of the "Access principle" to oil wells is the Cosasco mandrel for suspending tubing. It protects above-surface equipment by effectively blocking the tubing at the surface.

This means that maximum safety can be assured in the completion of wells, that the cost of extra master valves can be saved, and that well head equipment, including complete Christmas trees, can be replaced at will with complete safety.

The Cosasco mandrel has threads and a seat in its throat, so that a Cosasco plug may be installed and turned down as in the Cosasco nipple. The Cosasco mandrel thereby disposes of many hazards. Installation and removal of plugs under full pressure conditions is accomplished with the Cosasco Retriever, as described on the next page.

Various types of mandrels with the Access feature are available. Others can be made to your particular specifications.



COSASCO *Unitized*

WELL HEADS

Here, in a single-piece, forged-steel unit are combined the tubing handling openings, annulus control outlets and completion facilities of a well head and Christmas tree. It is compact, incorporates Cosasco Access features throughout, saves rig time and assures maximum safety at all times.

Cosasco Access nipples are installed at all outlets. A Cosasco Access mandrel for suspending tubing at completion is built in. The entry to the annulus, for instrument work, is optional.

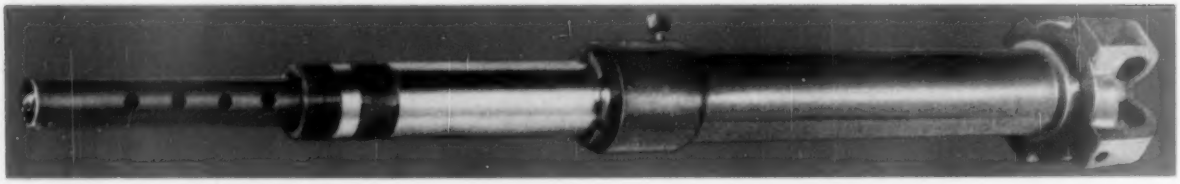
The well head illustrated is but one of several types available with Cosasco Access protection. Flow tees and combination tubing heads for high pressure conditions, for multiple completions, for gas lift and other specific requirements can all be supplied with Cosasco Access fittings built in.

Cosasco experience in oil field production and engineering created the "Access principle" to solve completion problems with safety.

See back page

The **COSASCO** *Retriever*

for installing and removing plugs under pressure

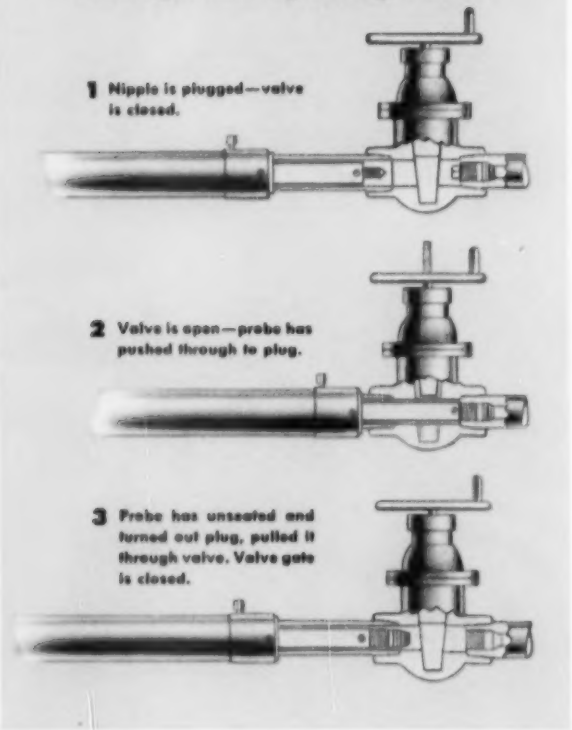


To gain entry through a Cosasco Access nipple or other fitting, a Cosasco Retriever is required. The Retriever consists of an outer cylinder and inner rod or "probe" having a common head. They ride respectively upon and within an inner cylinder. Packing cells within the Retriever are arranged so that when pressure is admitted into the inner cylinder from an outlet, it is balanced, permitting the outer cylinder and probe to be advanced, the probe going into the outlet.

With it, an operator can go through the gate of a full-opening valve to install or retrieve a Cosasco Access plug, thread-and-seat protector, corrosion coupon holder, or other device or instrument.

When he goes in to install a Cosasco Access plug and turns it down for a tight seal, he may then remove the valve. This means that any valve showing signs of leakage or other failure in high pressure service can be replaced promptly. If the failing valve should be the main valve at a well head, *the well can be saved.*

Retriever recovering plug through full opening valve


1 Nipple is plugged—valve is closed.
2 Valve is open—probe has pushed through to plug.
3 Probe has unseated and turned out plug, pulled it through valve. Valve gate is closed.

Cosasco engineers will help you with your specific problem

State your problem. Send us your blueprints. Cosasco engineers will gladly submit drawings detailing the Cosasco solution to any problem of entry through pressure. You will be under no obligation when you invite Cosasco to help.

Cosasco Access fittings are applicable to any pressure system, hydraulic or gaseous. They are particularly valuable when entry to live vessels, lines or containers is to be taken. Designs are adaptable to systems having specific characteristics, such as:

In the Petroleum Industry—at well heads, in refineries, along pipe lines, at storage or tank facilities ...for corrosion studies, sampling, thermocoupling under operating pressures.

In Processing Industries—wherever pressure or product losses from valve or fitting failure, or from shutdown for entry would be disastrous or costly...and for corrosion studies, sampling, thermocoupling while on stream.

In General Industry—wherever pressure gauges, valves, outlets, and bungs are employed.

COSASCO DIVISION PERFECT CIRCLE CORPORATION,
3463 Ocean View Blvd., Glendale 8, California.
Address mail to P.O. Box 277, LaCanada, California.
Export Office: 617 S. Olive St., Los Angeles 14, Calif.

COSASCO ACCESS FITTINGS ARE LISTED IN BOOKS OF STANDARDS BY ALL MAJOR OIL COMPANIES

mechanical operation in a 2-week course given by I.B.M.

Also, once the system is installed, it is immediately available for high-speed electronic data-processing equipment plus teletype communications.

How it works . . . A typical application of the system in a company will generally follow this pattern: (1) the person desiring information submits a data request form to the tabulating department, (2) the necessary adjustments are made on the process machines to obtain the pertinent cards, (3) the cards are then run through the printer where the information is transcribed on a readable form paper, (4) a specially designed heading sheet is attached to the readable form paper with the appropriate headings indicating what inforamtion is contained in the report.

Departmental applications . . . Virtually every department in the production and exploration side of an oil company will have use for the system. It will enable the:

. . . Geological department to get detailed information on formations and depths of wells in a particular field or area swiftly, eliminating the present time-consuming search of files.

. . . Drafting department to get detailed location, owner, and total-depth lists quickly.

. . . Production and engineering department to get pay-zone depths, initial production potentials, cuts, chokes, etc., in one easily accessible place.

. . . Geophysical department to get dope on formation tops in a drilled area to use as control points in shooting programs on adjacent acreage.

. . . Statistical department to quickly prepare comprehensive reports on footage drilled in any field, area, or pool, plus any other type of reports required on information contained on the punched cards such as casing programs, etc.

. . . Scouting department to get information quickly on wells drilled in areas near wildcat activity. Also to provide fast familiarization material for new scouts.

. . . Land department to make fast background checks to appraise submittals.

Of course the real worth of the well-history control system is the speed with which it makes available to department heads information needed to make policy decisions and plan drilling and production programs. Such information is of value only in relation to its availabilty to department heads. P.I.'s system doesn't contemplate making any new information available to the industry in California; rather it will make it more accessible.

Merchandising the system . . . The Petroleum Information well-history control system can be merchandised in an almost limitless number of ways.

It can be purchased in its entirety which will include subscribing to a regular P.I. service whereby subscribers receive new card sets on each new California well as it is completed. Companies using the system in this manner will have their own process equipment and personnel.

Several independents can jointly own and operate a complete system. Or, in the case of small companies, individuals, or service or supply firms, informtion can be requested and obtained from P.I. directly on a flat fee per job basis.

However, before any company can participate, it must agree to the release of all pertinent information not legitimately considered confidential on its own wells. The P.I. system recognizes the right of companies to withhold such data, but, P.I. expects companies to release the information as soon as conditions which originally made it confidential no longer exist.

Gathering data . . . P.I. is currently gathering data on California's completed wells from many sources, including microfilmed records from state agencies and major oil companies. However before any information is incorporated into the system clearance is first obtained from the well owner.

P.I. expects to bring California completion cards up to current drilling in about 3 months.

While the card system was specifically designed to fulfill information requirements on California wells, it is readily adaptable to use in other areas. P.I. is currently processing cards on other states for possible future systems installations in the Rocky Mountain area.

In announcing its new well-history control system, P.I. paid tribute to the excellent cooperation of California's oil industry. A special committee of geologists, scouts, and engineers from various companies assisted P.I. in solving the many problems encountered before the program was finally completed.

EXPLORATION

APPALACHIAN

WEST VIRGINIA

In Plymouth district, Mercer County, West Virginia, United Fuel Gas Co. 8424 W. S. Woodell, wildcat, elevation 2,456 ft., had a final of 561,000 cu. ft. gas, Maxon sand, total depth 1,828 ft.

● Magnolia district, Mingo County field. Dr. J. Frank Brown completed two large Big Lime gas wells. The No. 1 Emmett Ferrel gaged 11,210,000 cu. ft., total depth 2,650 ft., and No. 2 on the same lease was 15,056,000 cu. ft., total depth 2,281 ft. Carnegie Natural Gas Co. 11-1696 U. S. Steel Corp. came in at 9,184,000 cu. ft., total depth 3,050 ft.

PENNSYLVANIA

Young Township, Indiana County, Southwest Pennsylvania, New York State Natural Gas Corp. N-514 Florence Bodin, shut down at 7,520 ft. to fracture. The Tully was at 6,710 ft., Onondaga 7,327 ft., chert 7,343 ft., with a show of gas at 7,495 ft.

OHIO

A probable new pool was opened ½ mile south of production near Frazeysburg in Jackson Township, Muskingum County. Preston Oil Co. ¹ C. E. Micheal, Section 13, logged the Clinton at 3,005-57 ft. and gaged 45 bbl. with 200,000 cu. ft. gas in 24 hours after fracture.

● A ¼-mile extension to the Rich pool at Gratiot was completed by the Mutual Oil & Gas Co. on 1 Watts and Gillogly, Lot 33, Hopewell Township, Muskingum County. Clinton at 3,215-61 ft. made 110 bbl. in a 12-hour test after fracture.

● A gasser was found south of oil production in Bowling Green Township, Licking County, by the Cannon Oil Co. on 3 A. M. Cook, Section 3, Clinton at 3,124-92 ft.

EASTERN KENTUCKY

A wildcat test for Breathitt County has recently been completed as a dry hole. Located on Russell Branch,

Exploration this week

Appalachian	271
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Hugoton Embayment	277
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Western Canada	294
Successful Wildcats	298

United Fuel Gas Co. 1 Martha P. Downing was abandoned at a total depth of 2,400 ft. Significant markers included: Mississippian Big Lime 1,262 ft., Berea sand 1,752 ft and Corniferous lime 2,171 ft. Several shows of gas were had but after shot amounted to only 30,000 cu. ft. daily.

PACIFIC COAST

CALIFORNIA

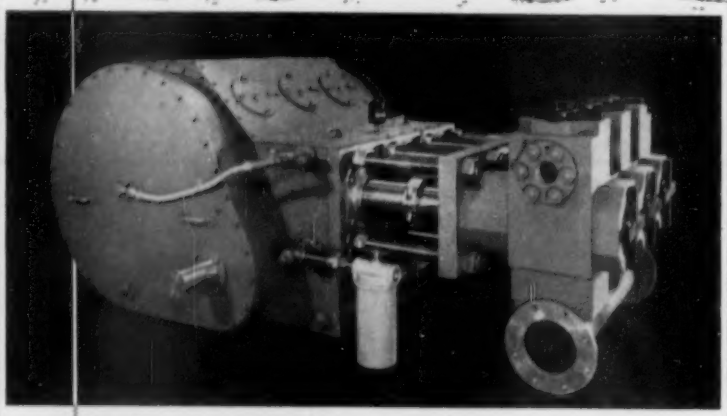
Ventura Test Blows Wild

W. R. Oil Co. was attempting to kill its wildcat, 4 Bailey, which blew out while coming out of the hole last week. The test, located in the Ojai-Lion Mountain region of Ventura County, was blowing oil-cut mud and gas 200 ft. in the air. The operator was cementing 5½-in. pipe when it blew out from 382 ft. of Sespe formation at 1,540 ft.

Intex Nears New Pool Discovery

Intex Oil Co. was reported nearing a new pool discovery 2 miles northwest of production in the Fruitvale field, Kern County. On a Schlumberger wireline test the well, 11-3 Law, recovered 15 cu. ft. of gas, 2,500 cc. of clean oil and 1,500 cc. of sand and water emulsion in 7 minutes. Fluid entry was calculated at 100 bbl. daily of 23°-gravity crude from 2,920 ft.

for HIGH Pressure Pumping DEPENDABLY ON JOB AFTER JOB!



20th Century Triplex Pump

With Working Pressures Up to 10,000 P.S.I.

Designed and built at the insistance of customers for our high-pressure pump fluid ends, this series 5000 plunger pump is built for all rugged jobs, yet is easily maintained in the field. It offers rugged dependability on high pressure pumping in mud, cementing, fracturing, waterflooding and other services. If you're having too many power-end breakdowns, we suggest that you . . .

WRITE FOR BULLETIN!

SPECIFICATIONS

Plunger — to 6½", Max. loading — 200,000#
W. P. — to 10,000 P.S.I. Size 55" x 38" x 93"
Max. Net H.P. — 750 Wt. Approx. — 10,500#
Max. Str./Min. — 210 List FOB Tulsa $25,000

20th CENTURY MFG. & SUPPLY CO. - 1600 S. PHOENIX - TULSA, OKLA.

Two More Producers for Honor Rancho Pool

The Texas Co. and Superior Oil Co. each gave the new Southeast pool of the Honor Rancho field, Los Angeles County, a new big producer recently. The pool was discovered last May by Texaco with a well flowing more than 1,000 bbl. daily. The two new completions are in that same class. Texaco's latest, 15 Honor Rancho, was brought in flowing 1,223 bbl. daily of 37° gravity crude from 400 ft. of the Miocene sand between 9,253-9,666 ft.

Superior's completion, 6 N. L. & F., was brought in flowing 800 bbl. daily from 300 ft. of the same sand through a 17/64-in. choke. Meanwhile, both operators were completing preparations for their next offsets.

Neaves Scores At San Mateo

Neaves Petroleum Development Co. joined Union Oil Co. with an oil discovery in San Mateo County. Neaves' successful wildcat is located in NE SE 17-7s-4w, which is about 6 miles northwest of Union's Oil Creek discovery of last October. The Neaves well, 2 Neaves-Union Oil-Lane, is in the rugged LaHonda region. It was completed as a new field discovery flowing 92 bbl. daily of 40° gravity crude through an 8/64-in. choke. Information on the exact producing depth of the 1,763 ft. deep wildcat is not available but it is known that production is from 13 ft. of Eocene age Butano sand, the same producing formation as Oil Creek field.

ROCKY MOUNTAIN

NEW MEXICO

Gas Flows at Gallup Prospect in San Juan

Anderson-Prichard Oil Corp. 1 Be Gay, C NW SW 25-25n-11w, San Juan County, flowed gas at the rate of 1,300 M.c.f. per day on a drill-stem test of the Gallup sand at 5,023-5,199 ft.

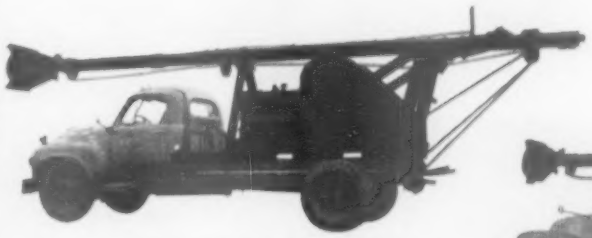
Location of this Gallup discovery is 6½ miles east of the Shell Oil Co. Carson Gallup oil strike in C NE NE 24-25n-12w. and 3 miles east of Anderson-Prichard's Es Ka Yazzie, C NW SW 28-25n-11w.

Carson area activity . . . Shell has three wells in this area shut in. The 3 Carson,

from the Shallowest to the Deepest

COOPER

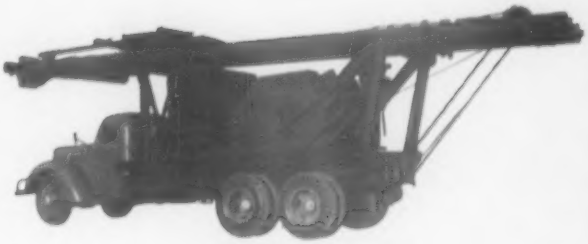
Servicing and Workover Units



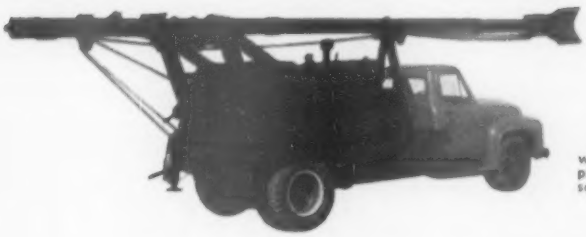
MODEL "B" SKID WINCHES
for servicing to 2,000 ft. of 2" tubing

MODEL "W" SERVICING WINCHES
for servicing to 3,500 ft. of 2½" tubing

MODEL "A" SERVICING WINCHES
with friction clutches. Four sizes with proper brake capacity and power for servicing from 4,500 ft. to 10,000 ft.



TORQUMATIC "420" AND
TORQMATIC "520"
servicing and rotary workover units. Have torque converter and full torque shifting transmissions — to 300 h.p.



MODEL "P" SERVICING WINCHES
with positive clutches. Three sizes with proper brake capacity and power for servicing from 3,500 ft. to 8,000 ft.

If you prefer separate engine units for servicing and workover jobs to 10,000 ft. there's bound to be the right one for your work among the many models and sizes built by COOPER.

And, you can equip it to suit your needs from standard extra equipment: Single and two pole telescoping pipe masts or telescoping fabricated masts, racking boards, rod hangers, sand line sheaves, drum dividers, rotary drives, catheads, jerk line spudders, etc.

Cooper builds the most complete line of separate engine winches . . . there's a size and type to handle any depth well or field condition.

FRED E. COOPER TULSA DRAW WORKS SPUDDERS WINCHES POWER UNITS

Originator of Mobile Winch Units

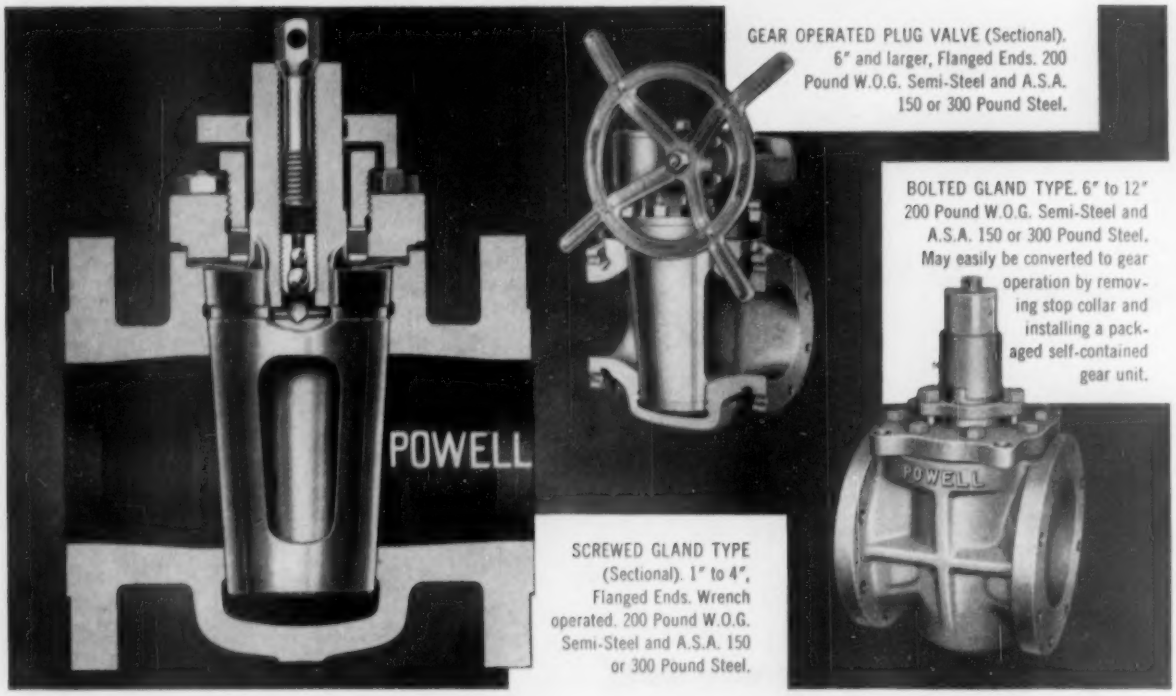
FRED E. Cooper, Inc.

P. O. Box 1890 TULSA, OKLA.

Branches: Houston, Odessa, Los Angeles, Olney

POWELL

Lubricated Plug VALVES



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UTAH

Hermosa Discovery Finaled at Bluff

The Bluff Unit 3 Unit well in San Juan County was completed for 138 bbl. of oil per day on 32/64-in. choke from perforations in the upper Hermosa at 5,470-95 ft. Shell Oil Co.'s well is 3½ miles north of the Recapture Creek discovery in the Aneth region.

MONTANA

Extension Well at Northeast Bredette Finaled

Carter Oil Co. completed the 1 Tong, an extension well in Northeast Bredette field, Daniels County, northeastern Montana. The well, located in C NW NW 34-33n-49e, flowed 720 bbl. of oil per day from the MacGowan. This is the best gage to date in the field.

The California Co. opened the field earlier this year at 1 Paulson in C NW SW 34-33n-49e, flowing 114 bbl. per day from perforations in both the MacGowan and Charles C zones. Location of Northeast Bredette field is 2 miles north of East Bredette pool.

Forest Hits Gallup In San Juan Well

Forest Oil Corp. has a Gallup sand oil discovery at 1 Federal, C NE NE 13-24n-10w. The well pumped 120 bbl. of oil daily from perforations at 5,428-61 ft. Location is 8 miles northwest of Chaco Canyon production, and 16 miles southeast of Bisti field.

Another Gallup well in this area is H. L. Fannin 1 Vanderslice, C SW SW 13-24n-12w. This one pumped oil at the rate of 9 bbl. per hour from perforations at 4,451-56 ft. Reynolds Mining Co. is drilling below 5,942 ft. at the 1 Huerfano, NW SE SW 33-25n-9w. The operator recovered heavily oil and gas-cut mud on test at 4,938-72 ft.

ARIZONA

Bita Peak Confirmation Try is Abandoned

El Paso Natural Gas Co. gave up at the 2 Bita Peak, confirmation well to the recent gas discovery in SW SW NW 19-41n-31e, Apache County. The confirmation well, NE SW NE 26-32n-21w, was abandoned with no details released as yet. The confirmation well is across the state line in New Mexico's San Juan County, 1½ miles east.

BASIN AND RANGE

NEVADA

Shell Oil Co. has abandoned its latest effort to find additional production in Nevada. Shell gave up on 1 Diamond Valley at 8,042 ft. after running electric logs, gamma ray neutron log, dipmeter and velocity surveys. This wildcat was located in Diamond Valley, Eureka County, about 100 miles north of Shell's Railroad Valley production. Location of the unsuccessful test was NE NW 30-23n-54e in north-central Nevada.

GREAT LAKES

MICHIGAN

A Saginaw sand gas pay that was gaged for a maximum open flow of 1,571,000 cu. ft. a day, flowing by heads, was under test at Lakeland Oil Corp. 1 State-Edenville, SE SW NE 5-16n-1w, Midland County. Gas pay was logged just below the glacial drift between 382-94 ft.

Tests were being run at 394 ft., total

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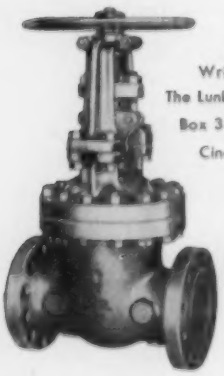

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depth. Between 382-87 ft., well showed for 1,087,000 cu. ft. of gas a day. An increase in gas was logged between 387-94 ft. and well was gaged good for 1,571,000 cu. ft. When well was tested at this maximum flow rate, some water showed. However, when well was restricted to 1,240,000 cu. ft. well produced water-free gas.

While several other test wells in this, the deepest part of the Michigan basin have shown evidence of gas from the Saginaw sand (in the Pennsylvania series), this is by far the best gas showing ever recorded from this sand in Michigan. Well may be saved as a shallow gas discovery, providing additional tests indicate sufficient volume and a high enough B.t.u. value.

Wildcat, located about 2 miles south and east of South Beaverton Dundee oil pool, was originally spudded as a 4,000-ft. Dundee objective oil test. It is the diagonal southwest 40-acre offset to an older test drilled by Sun Oil Co. that logged a near commercial oil pay in the Dundee. No test of Saginaw gas sand was recorded at the Sun wildcat.

HUGOTON EMBAYMENT

OKLAHOMA PANHANDLE

Chester Is New Pay At South Greenough

South Greenough field in Beaver County, formerly a Morrow sand producer, has indicated gas production in the Chester lime (Mississippian). The new-pay prospect is Cities Service Oil Co.'s 1 Beard-A, C SW NE 8-5n-22eCM.

Acidization of perforations at 6,630-35 ft. produced 2,350 M.c.f. of gas per day.

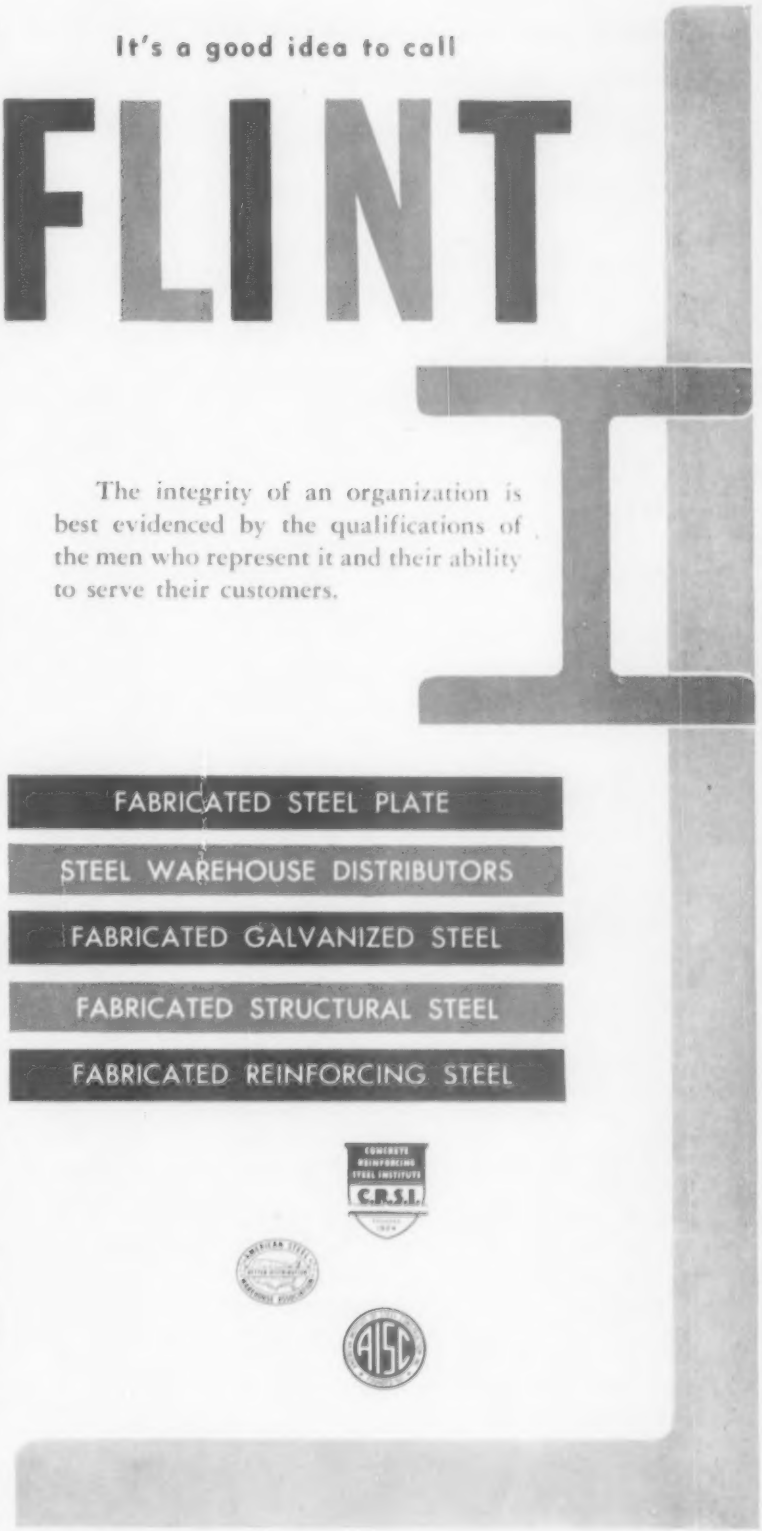
NORTHWEST OKLAHOMA

New Pool Opened In Harper Coupnty

Harper County has a new gas pool. The discovery well is Eason Oil Co. and Wilcox Oil Co. 1-C Hovey Estate, C SW NW 36-25n-23w. A drill-stem test at 7,425-7,515 ft. flowed gas in 1 minute at the estimated rate of 2,800 M.c.f. per day.

Two Pays Flow Gas At Harper Discovery

Keating Drilling Co. 1 Dunn, NW NW SE 22-28n-26w, Harper County, flowed gas from both the Chester and Morrow. From the Chester after acidization the well flowed 1,350 M.c.f. per day, and 3,120 M.c.f. from the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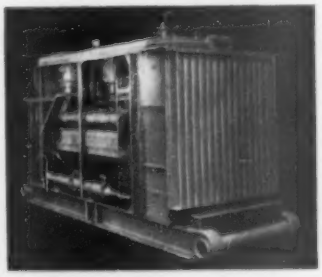

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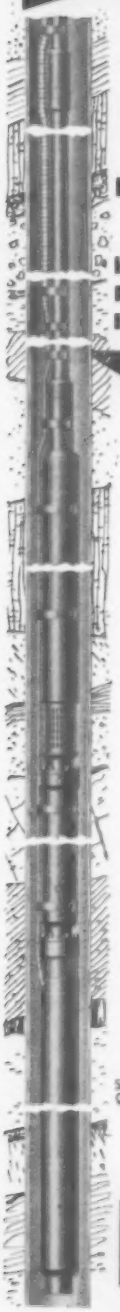
J-18

REDA PUMPS



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Morrow. Perforations in the Chester were at 6,478-6,502 ft. The Morrow produced from perforations at 6,354-72 ft.

SOUTHWEST KANSAS

Gas Pool Opening In Meade County

Monsanto Chemical Co. and R. W. Rine Drilling Co. 1 Marion, C Lot 2, 14-35s-27w, 6 miles southwest of McKinney gas field in Meade County, just north of the Oklahoma state line, gaged 2,040 M.c.f. of gas per day on drill-stem test at 6,264-85 ft. in the Mississippian.

The Texas Co. has a gas discovery at 1 Sanders in SE NW NE 13-32s-29w, 5½ miles northeast of Angell pool. This one flowed 9,153 M.c.f. of gas per day, open flow from perforations in the Mississippian.

Essay Awards Announced By S.E.G.

Cash prizes in the annual world-wide student essay contest of the Society of Exploration Geophysicists were awarded in New Orleans as the opening session of the society's 26th annual meeting. F. J. Agnich, chairman of the student membership committee, and president of Geophysical Service, Inc., Dallas, presented the first prize of $150 to Thomas V. McEvilly, the second prize of $100 to Ronald E. Diedrich and the $50 prize to Emil J. Mateker, Jr.

McEvilly, a graduate fellow in engineering geophysics at St. Louis University, wrote on "Abnormal Sedimentary Susceptibilities in Eastern Missouri."

Diederich, a geophysical engineering student at Colorado School of Mines, Golden, titled his paper "A Review of the Rayleigh Wave." Mateker is also a graduate student at St. Louis University. His paper is entitled "Gravity Survey of the Cap Au Gres Structure in the Brussels-Hardin Quadrangle, Illinois."

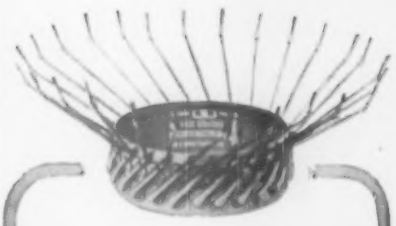
MID-CONTINENT

OKLAHOMA

Deep Pay Discovery Flows in Aylesworth

The shallow Aylesworth field in Marshall County, southern Oklahoma, has a new deep pay discovery at Blackwell Zinc Co.'s 7 University of Tulsa, SE NW NE 5-6s-6e.

The new pay is the Tulip Creek sand



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(Ordovician) at 4,574-89 ft. After fracturing the well flowed at the rate of 18 bbl. per hour with a good gas volume.

Tests Improve Northwest Cement Strike's Prospects

Improved recovery on tests was reported at Amerada Petroleum Corp.'s 1 Leasenby, Northwest Cement field deep test in NW SE SE 19-6n-10w, Caddo County.

Acid wash and fracturing caused the well to flow new oil from about 40 bbl. per day to a rate of 217 bbl. in 19 hours on ¾-in. choke. There was also a 56-bbl. fresh water flow. Pay is the Yule sand at 6,532-48 ft.

Flow Tests Conducted At New McClain Hit

Weimer, Fiszhugh, and Pyramid Oil Co. took flow tests at their 1 Hanley Ordovician discovery in McClain County, south-central Oklahoma. The well flowed 60 bbl. of oil in 3 hours on 18/64-in. choke from the Hunton lime at 9,130-60 ft.; from the deeper Bromide sands it made 65 bbl. in 2 hours on 10/64-in. choke from perforations at 10,192-10,202 ft.

The discovery is located in C SW NE 5-5n-3w. Two offsets, a west and south, are now drilling in the new area.

...1 Little discovery. Gene Goff and Goff-Leeper Drilling Co.'s McClain County Ordovician discovery is still testing after an over-all gage of 745 bbl. of oil per day was reported from the Bromide sands on 13/64-in. choke. This well is in C NW SE 4-5n-3w. Production has been assured in the Hunton, and the first and second Bromide sands.

Hunton Oil Found At Blue Hill

An extension well at Blue Hill in McClain County, south-central Oklahoma, found a small showing of free oil in the Hunton lime. J. R. McDermott 1 Weeden, C NW NW 31-8n-3w, recovered 5 ft. of oil and 55 ft. oil and gas-cut mud on test in the Chimney Hill at 10,205-245 ft.

Southeast Rich Valley Extended In Grant

Grant County's Southeast Rich Valley field in northern Oklahoma has been extended. The extension success is Livingston Oil Co. 1 Kirbb-A in NW NW NW 8-25n-4w.

A drill-stem test in the Mississippi chat at 5,200-16 ft. recovered 2,310 ft. of oil, and gas-cut mud. Completion gage was 32 bbl. per hour on 30/64-in. tubing choke.

Wilcox Discovery Reported In Cleveland County

Anderson-Prichard 1 Allison, NE NE SW 27-8n-2w, near Noble townsite in Cleveland County, central Oklahoma, is reportedly a Wilcox sand oil discovery. Two drill-stem tests recovered oil, according to reports. No other details have been released.

Chat Discovery Finaled In Kay County

The 1 Palice has been completed as an oil discovery well in Kay County by Lion Oil Co., a division of Monsanto Chemical Co.

The well flowed 324 bbl. of oil, with no water, in 24 hours through a 19/64-in. choke on state potential test. It was completed in the Mississippian chat from 11 ft. of open hole at a total depth of 4,388 ft.

Located in the NW ¼ of 24-25n-2w, the discovery well is approximate-

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ly 1 mile west of the 1 Partenheimer, which Lion completed earlier this year. Drilling has begun on an offset well designated as the 1 Ella.

Dual Completion Added At Griggs Pool

A new pool in southeastern Cimarron County in the Oklahoma Panhandle will get its second well. Phillips Petroleum Co. will dually complete its 1 Wells, C SW SE 30-1n-9eCM, north of the field discovery well.

The second well flowed 3,911 M.c.f. of gas per day from 3,229-3,417 ft.; 5,400 M.c.f. per day from 3,444-3,552 ft., both open zones. Production is from Pennsylvanian.

North Madill Report

Sinclair Oil & Gas Co. made flow tests at a Madill field well in Marshall County. The 1 Thompson-McCullough in NW NW NE 15-5s-5e, flowed oil at the rate of 113 bbl. in 7 hours on ¾-in. choke. Perforations were at 6,548-6,616 ft. in the second Bromide sand; 6,668-6,704 ft. in the third Bromide sand. Before fracturing the well flowed 20 bbl. per hour.

KANSAS

Discovery Indicated At Sheridan Wildcat

Empire Drilling Co. tested slight oil and gas shows in the Kansas City lime-Pennsylvanian at 1 Koerber in SE SE SE 24-10s-29w, southern Sheridan wildcat. The northwestern Kansas test is about 17 miles west of production in Custer pool and 3 miles west of the town of Hoxie.

The drill-stem test at 4,022-40 ft. recovered 600 ft. of gas, 15 ft. gassy oil, 30 ft. of watery, muddy oil and 300 ft. of muddy salt water. Other drill-stem tests recovered clean oil and oil-cut mud.

New Gas Area Opens In Kiowa County

Anschutz Drilling Co. 1 Stewart, NE NE NE 35-27s-18w, 5 miles northwest of Brenham gas field and 3 miles northeast of the town of Greensburg in Kiowa County, was completed flowing 2,700 M.c.f. of gas per day from the Kinderhook - Mississippian at 4,746-54 ft.

Book Review

THE GEOLOGY OF NORTH DAKOTA, by John L. Hainer. Published by the North Dakota Geological Survey, Grand Forks, N. D., 46 pp.

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The North Dakota Geological Survey now has available a new bulletin, "The Geology of North Dakota." The approach and geological concepts are intended primarily for a layman and for student geologists. It is a very general summation of the geology of the state and is intended to stimulate further investigation. The bulletin contains an excellent bibliography for those interested in pursuing this subject further.

BOOK REVIEW

The National Oil Scouts & Landmen's Association Year Book, Volume 26, has been issued. The book is a review of 1955 oil and gas field development in the United States and western Canada.

This new volume covers every oil producing area on the continent. It lists field production, exploratory activity, new pays, extensions, and blocks assembled.

T. H. Robinson, Phillips Petroleum Co., Evansville, will be editor of the 1956 volume, work on which has already begun. New officers of the association are: Kelly Scott, president; Dan Ottinger, secretary-treasurer; Frank Wood, Jr., first vice president; A. T. Murphy, second vice president; E. D. Bell, third vice president; and T. H. Robinson, editor-in-chief.

ARK-LA-TEX

NORTH LOUISIANA

Gage Taken at Bull Creek Discovery Well

Carter Oil Co. completed the discovery well of Bull Creek field in Union Parish, north-central Louisiana. The 1 Minnie Mitcham et al Unit, NW C SW¼ 20-21n-3w, 2¾ miles southwest of Bernice, flowed 132 bbl. of condensate and 2,663 M.c.f. of gas per day from open hole in the Smackover lime at 10,344-10,423 ft. Effective pay zone totals 20 ft.

Franklin Parish Records New Oil Discovery

A new oil pool was opened in Franklin Parish, northeastern Louisiana. The discovery well is Jones-O'Brien, Inc., and Custer Primos 1 Margarette Franks in C NW SE 36-1n-7e, 3 miles southwest of Baskinton field. The well flowed 192 bbl. of 40°-gravity oil per day on ¼-in. choke from perforations in the Tuscaloosa at 3,622-26 ft.

EAST TEXAS

Completion Made at Bethel Salt Dome Test

The Texas Co. has made final tests at its 3 E. C. Williams, 7 miles northwest of Tennessee Colony, on the Bethel salt dome in Anderson County.

Flowing through 12/64-in. choke, the well rated a daily potential of 140 bbl. of 30.5° oil, plus 40 per cent water, from Woodbine perforations at 5,758-64 ft. Gas-oil ratio was 350:1.

Location in Juan N. Acosta Survey, A-1, is a southwest offset to Texaco 2 Williams, Woodbine discovery on the dome.

South Slocum . . . Development work continues good in the Slocum fields of Anderson County. Last week Thomas D. Humphrey & Sons completed two wells in South Slocum field. The firm's 2 Wallace pumped 102 bbl. of oil a day from the Woodbine at 5,932-39 ft., and the 4-A Wallace completed, flowing 154 bbl. of oil a day. The latter was gaged through 11/64-in. choke, from perforations at 5,932-34 ft.

Wildcat work in Anderson County included locations for Oil Properties, Inc. 1 Thompson, a proposed 6,200-ft. test 2 miles southwest of Denson Springs. Location is in John Grigsby Survey, A-314. Another wildcat location is Talbert & Gulley 1 Pine Lodge Clubs, Inc., a 6,000-ft. test 3 miles east of Elkhart, in Phillip Martin Survey. Both operations will seek Woodbine pay.

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Antelope Logs 300-Ft. Pay Section In Williston Basin

by Norman S. Morrisey
Drilling-Development Editor

DISCOVERY of Madison oil is commonplace in the Williston basin—but Madison oil fields with 300 ft. of gross pay section are unusual.

In fact, Antelope is the only field in the basin that has logged such a thick pay section. The field was discovered May 12, 1956, with the successful completion of Amerada Petroleum Corp. 1 Lacey-Norby (SE NE 1-12n-95w, McKenzie County, North Dakota).

The discovery well encountered some 300 ft. of gross productive Madison limestone according to data based on cores, drill-stem tests, and electric log analysis. The 1 Lacey-Norby flowed at the rate of 386 bbl. per day on completion tests through a 14/64-in. choke.

Drilling has already outlined over 1,200 acres that are productive.

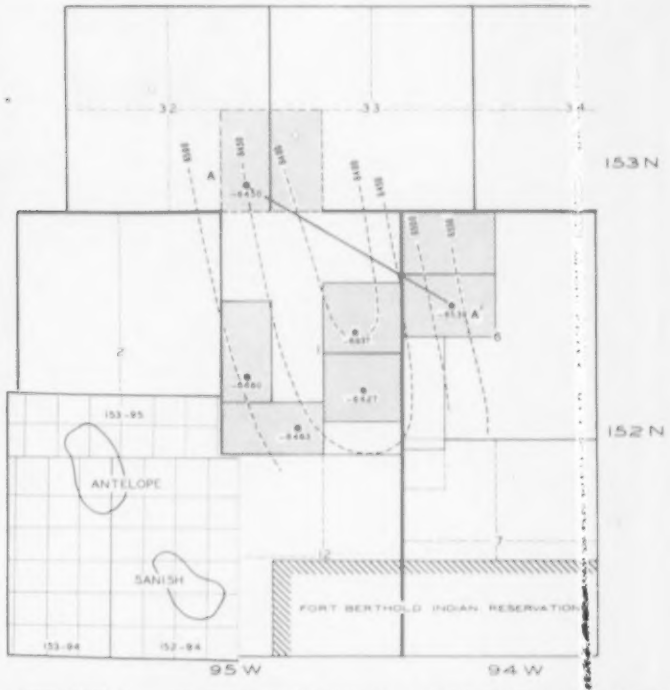
Structure . . . Detailed geophysical work led to the discovery of Antelope. The structure is a pronounced anticlinal nose that trends roughly north-northwest south-southeast. The trend may be related to Sanish oil field that lies only 4 miles to the southeast.

Subsurface control shows abnormally steep dip on the east side of the structure and there is at least 132 ft. of relief at Madison limestone level. Critical north dip has not been established. Although there is no question about the presence of an anticline at Antelope there is not enough data to delineate the structural axis or the productive area.

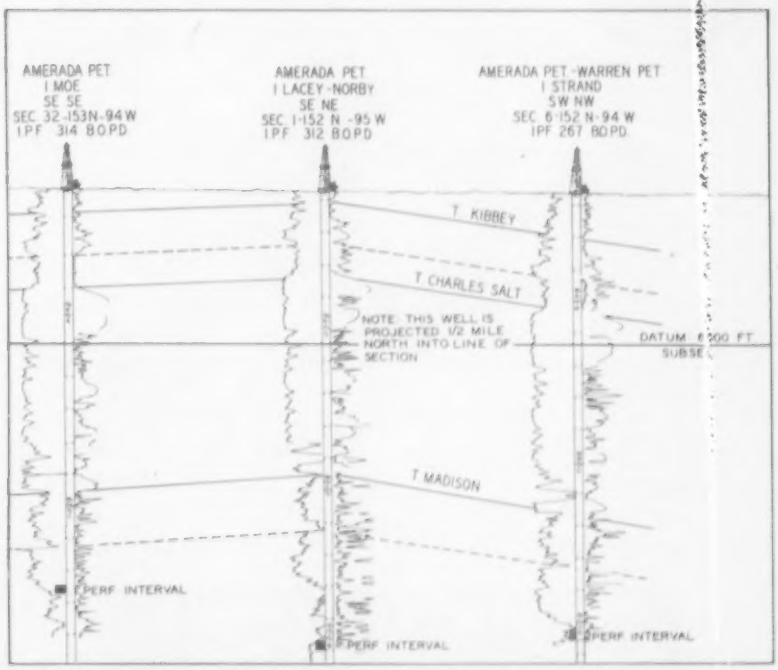
Drilling and completion . . . Development at Antelope is on 80-acre spacing. The Madison limestone occurs at drilling depths of 8,500-8,700 ft. Usual procedure is to carry the wells to a total depth of about 9,100 ft. The oil string is set on bottom. Wells are completed through perforations. The pay zone is normally treated with 2,000 gal. of acid.

Most of the drilling is on a daywork basis with current day rate of $925 plus drill-pipe rental. The 9,100-ft. wells at Antelope require only 46 days from spud to completion. Recent wells have been drilled quicker.

Drilling through the salt section requires careful mud control. And because of the salt, the operator runs heavy-duty casing to eliminate any chance of collapsed casing. This has occurred in Madison wells on the



ANTELOPE is a pronounced anticlinal trend at Madison limestone level and may be related to Sanish field 4 miles southeast. Datum is top of Madison limestone. (Base map courtesy of North Dakota Geological Society. Preliminary structural interpretation by author.)



WELLS AT ANTELOPE are completed 250-500 ft. below top of the Madison limestone, but the discovery well (center), 1 Lacey-Norby, indicated production from 8,645-8,716 ft. This well produces through perforations between 9,057-88 ft.

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Nesson anticline and has required expensive workover jobs.

However by drilling through the salt section with a supersaturated salt mud and by using heavier casing, the danger is minimized according to Amerada's engineers.

Spacing . . . Drilling units are set up on 80 acres and are based on reservoir characteristics rather than surface ownership. The area is very irregular from the standpoint of lease ownership and land surveys.

Wells must be kept 1,500 ft. apart and at least 500 ft. from drilling-unit lines. Engineers feel that this spacing will adequately drain the reservoir. This temporary 80-acre spacing order will expire January 6, 1958, and a spacing hearing will be held in December 1957, to determine proper spacing at Antelope.

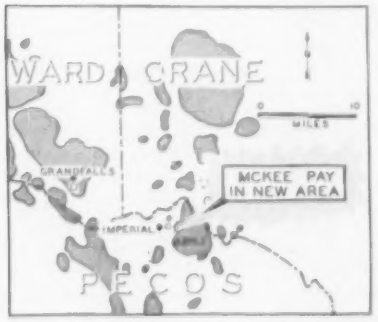
WEST TEXAS-NEW MEXICO

WEST TEXAS

Dual Andrews Discovery Gets North Outpost

W. E. Bakke & Choya Drilling Co. 2 Grady "A," ½ mile north extension to the same operators' recent Devonian and Ellenburger discovery in southeastern Andrews County, has been completed from one pay zone.

No. 2 Grady "A" finished in the Devonian and was testing the Ellenburger for dual completion. Potential from the Devonian at 10,530-46 ft. was at the rate of 732 bbl. of oil a day, based on an 8-hour test which gaged 243.84 bbl. Choke was ¼-in., tubing pressure was 800 psi., and gas-oil ratio was 921:1. Location is 4 miles southeast of Andrews.



Great Western Drilling Co. 1 Cotton, 10-3-H&TC, 1 mile east of Imperial, flowed 194 bbl. of oil in 2 hours and 5 minutes on a test of the McKee section at 5,404-52 ft. Location is in a new extension area of Abell, West, where production is in the Waddell.

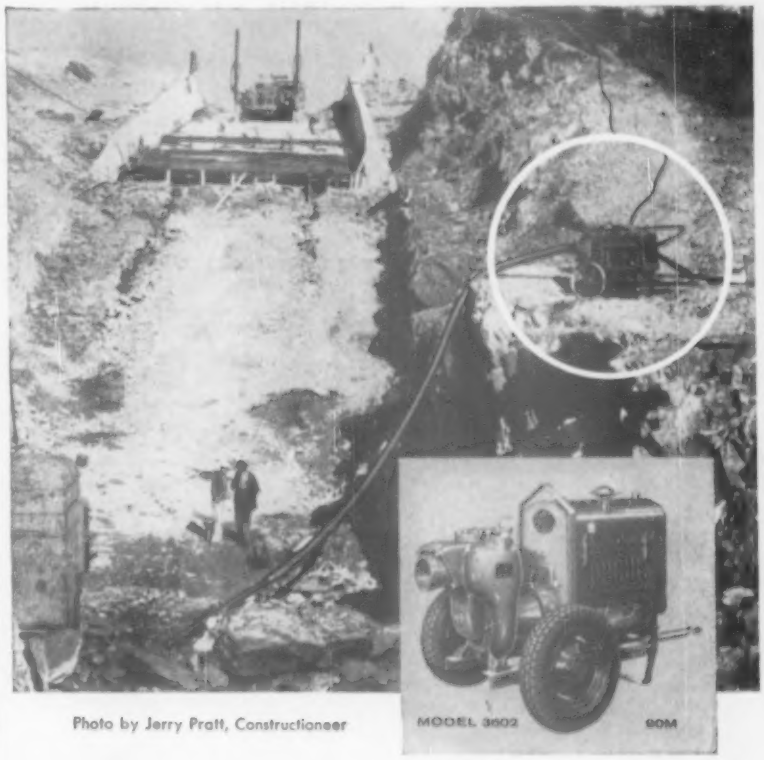


Photo by Jerry Pratt, Constructioneer

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Seepage on construction near Spring Grove, Penna., is quickly removed by a Gorman-Rupp 90M Pump, Model 3602, letting work proceed on the removal of solid rock. The pump stands about 20 feet above water level and is discharging over the rise as shown in the upper right of the picture. The 500-ft. spillway chute handles overflow from the 2½-sq.-mi. dam.

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War-San Field Gains Fourth Pay Zone

War-San field in southwestern Midland County added a fourth pay, the Wolfcamp, to its producing zones. Other pays are the Pennsylvanian, Fusselman and Ellenburger.

The new-pay opener is Warren Petroleum Co. 1-G TXL, 39-41-T3S-T&P Survey. Flowing potential was 282 bbl. of oil a day through 30/64-in. choke, from perforations at 9,795-9,926 ft. Flowing tubing pressure was 120 psi. and gas-oil ratio was 1,909:1. Location is 19 miles southwest of Midland.

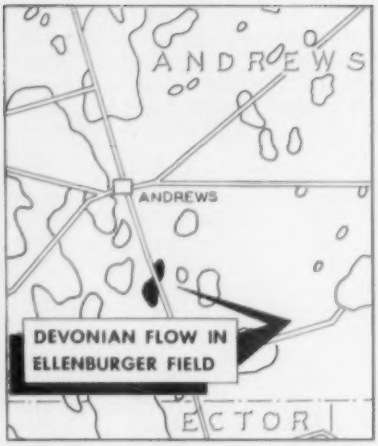
Devonian Pay Assured In Andrews County Field

Flowing oil from the Devonian has assured a new pay zone for Midland Farms, Northwest (Ellenburger) field, southeast of the town of Andrews.

The new pay prospect is Carlton Beal & Associates 1-10 University, in Section 10, Block 1, ULS Survey. On a flow test of the Devonian, without acid treatment, between 10,798-10,814 10,-830-10,954 and 10,969-84 ft., the well kicked off and flowed 52 bbl. of oil in 3 hours. Choke size was 10/64-in., and tubing pressure was 1,000 psi.

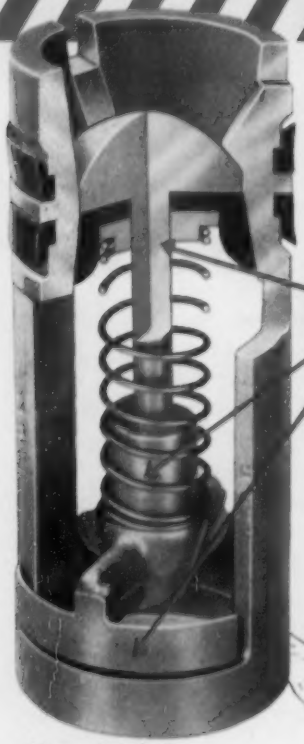
Operators planned to perforate in the Pennsylvanian and attempt completion as a dual discovery. While drilling, tests around 8,948-9,119 ft., in the Strawn, recovered heavily oil-cut mud.

Nearest Devonian production is over 2 miles to the southwest in Andrews, South field. Ellenburger production in the area is assigned to Midland Farms, Northeast field. Leonard, Wolfcamp, and Devonian production in the area is assigned to Andrews, South field.



Carlton Beal & Associates 1-10 University has added Devonian oil to Midland Farms, Northwest (Ellenberger) field in Andrews County.

The "WINNER" by a landslide!



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SOUTHEAST NEW MEXICO

Record Deep Test Is Plugged Back in Lea County

Phillips Petroleum Co. 6 Lea-Mex, Southeast New Mexico's deepest test, in 23-17s-33e, has been plugged back and completed as a Pennsylvanian discovery.

Location of the discovery is in east-central Lea County, between East Maljamar and Vacuum fields. It was drilled a few feet into the pre-Cambrian, with total depth at 16,842 ft., then plugged back to 11,358 ft. Potential was 264 bbl. of 37° oil through ⅜-in. choke, from perforations at 11,316-52 ft. Gas-oil ratio was 1,061:1, and tubing pressure was 150 psi.

South Saunders area oil shows . . . Humble Oil & Refining Co.'s two tests in this area reported oil shows on tests. The firm's 1-AQ State, 3-16s-33e, scheduled to 14,000 ft., developed a flow of gas and recovered 3,170 ft. of oil while drill-stem testing at 10,800-72 ft. Drilling continued following the test.

Humble 1 South Saunders Unit, 1-16s-33e, plugged back from total depth 14,377 ft. to try for a Pennsylvanian completion, swabbed 106 bbl. of oil and 53 bbl. of acid water in 16 hours.

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LEVELING RIGS and temporary support of machinery are two jobs where Simplex Screw Jacks are well-suited. They can be safely left in place indefinitely, are relatively inexpensive and can be adjusted to fractions of an inch.

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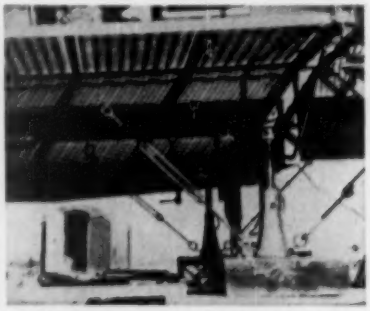

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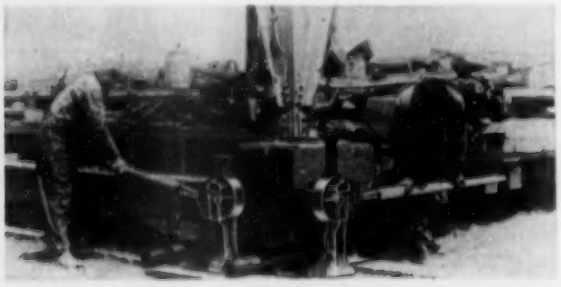
Simplex "Jenny" Hydraulic puller draws pull rod through its 'center hole' to simplify set-up and make pulling easier



Sometimes it takes two . . . With right and left hand toes, respectively, Simplex Nos. 126 and 127 ratchet lowering geared jacks can be used as a pair for lifting and lowering rigs or other heavy equipment, 25-ton capacity on cap or toe. Powerful geared mechanism makes jack faster and easier to use than standard speed types

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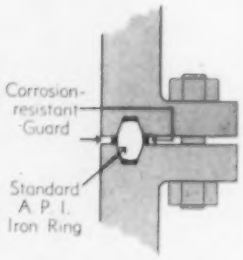

Field-proven "Flex-Tip" gaskets are the safest, most reliable ring joint flange seal in oil field use. Flexible inner and outer ring guards are bonded to the ring metal, providing non-corrosive surfaces. The tip of the PETROMEC ring-joint gasket, contacting the groove, provides a secondary seal in addition to the regular steel-to-steel seal of the A. P. I. ring.

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The test was run on perforations at 10,906-40 ft.

Outpost started . . . Sinclair Oil & Gas Co. has filed application to drill 3 Seaman Unit as a ¾-mile south offset to its recent discovery. Location is in NE SE 24-16s-33e. Projected depth is 13,000 ft. Sinclair's 1 Seaman Unit completed in October for 612 bbl. of oil a day from pay at 11,219-65 ft.

SOUTH LOUISIANA

Second Deep Well Verifies South Jennings Extension

Sun Oil Co. is confirming its recent extension and deeper-pay discovery at South Jennings, in Acadia Parish. Its second well, 1 Hebert, a quarter mile northwest of its extension discovery, flowed gas and condensate with pressure of 8,600 psi. while cleaning. Flow was not gaged, and the well was shut in pending potential tests, but is estimated at least as good as that of the initial well, which produced at the rate of 2,085,000 cu. ft. of gas and 163.3 bbl. of 49.4°-gravity condensate per day through ⅛-in. choke.

Pay zone of the confirmation well is perforated at 12,376-80 ft. It is identified as the discovery well's pay, which is perforated at 12,356-66 ft. The confirmation well was drilled to 15,020 ft.

The extension area, opened last April, is about a mile south of South Jennings field, where Stanolind Oil & Gas Co. has gas-condensate production from sands ranging in depth from 8,600 to 10,900 ft.

Sun is moving about ½ mile farther west around the flank for its third well, 1-A Hebert, which is expected to be drilled to about 13,500 ft.

Deep Oil-Pay Discovery At Belle Isle Confirmed

Discovery early this year of a 13,500-ft. lower Miocene oil-productive reservoir on the north flank of the old Belle Isle dome, in St. Mary Parish, is being confirmed by the completion of the second well in that zone.

The confirmation is by Sun Oil Co. at its 4 St. Mary Parish Land Co., which flowed at the rate of 216 bbl. of 31.3°-gravity oil per day through 7/64-in. choke. Flow was under pressure of 2,200 psi. with gas-oil ratio of 888 cu. ft. per barrel. Pay is perforated at 13,516-24 ft. Total depth is 14,800 ft.

Sun's discovery well, 2 St. Mary Parish Land Co., produced at the rate of 260 bbl. of 32.6°-gravity oil per day through ⅛-in. choke with pay perforated at 13,498-504 ft.

LOUISIANA OFFSHORE

West Cameron Block 192 Adds Two More Pay Zones

Two additional sands have proved productive in C.A.T.C. group's West Cameron Block 192 field, in the Gulf of Mexico, 30 miles off the coast of Cameron Parish. They make a total of seven sands found productive so far in this field.

The new sands, one perforated at 5,473-78 ft., and the other at 6,308-26 ft., are in the group's 2-B State Lease 1656 (OCS 0190). The well is completed dually, flowing 2,780,000 cu. ft. of gas per day through ¼-in. choke from the shallower zone, and 3,400,000 cu. ft. of gas per day through the same sized choke from the deeper pay. Both flows carried sprays of condensate.

Other sands in the field range in depth from 4,900 to 8,800 ft. The field, discovered in July 1954, now has seven productive wells, two dually completed. Two dry holes have been drilled.

C.A.T.C. Group Completes Grand Isle Oil Discovery

The C.A.T.C. group, with Continental Oil Co. as operator, has an-

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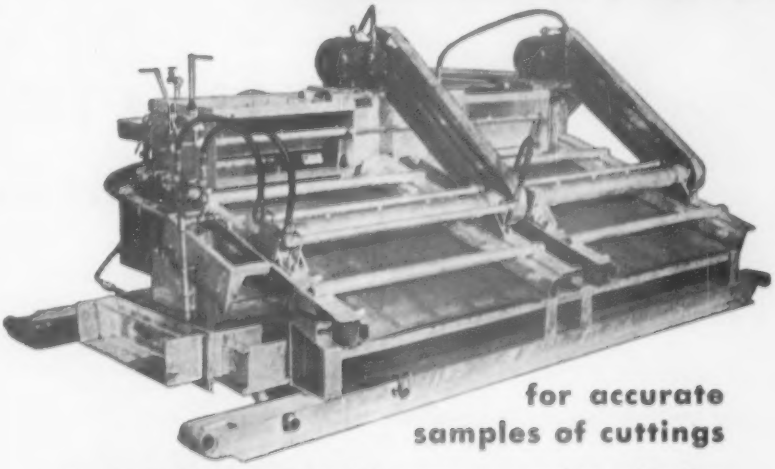

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other offshore discovery, located 20 miles off the coast of Jefferson Parish in Grand Isle Block 43 area. It is in its 1-A State Lease 1490 (OCS 0175), completed with a flow of 75 bbl. of 52.3°-gravity condensate and 1,287,000 cu. ft. of gas per day through ⅛-in. choke.

The well drilled to 15,523 ft., is productive from casing-perforated interval at 12,731-41 ft. in Miocene sand. Hole was plugged back to 12,745 ft. into casing cemented at 13,505 ft. The well's flow was under pressure of 4,650 psi. through the ⅛-in. choke.

The group's next well, 2-A State Lease 1533 (OCS 0181), will be drilled directionally from the same platform to a bottom location in Block 69, West Delta area, in Plaquemines Parish. The latter block adjoins Grand Isle Block 43 on the east.

SOUTH TEXAS

SOUTHWEST TEXAS

Deep Val Verde Wildcat Fails to Get Production

Stanolind Oil & Gas Co. is abandoning its deep wildcat 9 miles northwest of Juno, in northwestern Val Verde County in Texas' far-southwestern region.

Abandonment follows a series of unsuccessful tests, first in a 14,700-ft. horizon, possibly Ellenburger, and more recently in a shallow sand at 750-80 ft.

The wildcat, spudded last December, was drilled to 15,673 ft.

Shallow Wildcat Produces

Another Navarro discovery, located in northeastern Williamson County, near the Milam County line, has been made by Bernard & Nelson, of San Antonio, at their 1 Griffin estate, in the Harrison Owen Survey. Nearest other Navarro production is in the Minerva-Rockdale area, about 20 miles northeast.

It is a small, shallow discovery with pay interval at 784-98 ft. After swabbing the well flowed at the rate of 6 to 7 bbl. of oil per day. Total depth is 2,316 ft.

TEXAS GULF COAST

Sixth Sand Produces in Texas Offshore Field

Another sand, the sixth, has proved productive in High Island Block 10-L field, in the Gulf of Mexico, off the coast of Jefferson County. It is the shallowest so far opened. Perforated

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interval is 5,197-5,211 ft. Others range in depth from 7,700 to 10,400 ft.

The new pay is in Magnolia Petroleum Co. and Stanolind Oil & Gas Co.'s 9-A Texas Gulf Tract 10. The well's open-flow potential is rated at 23,000,000 cu. ft. of gas per day. Flow through chokes was at the rate of 3,444,000 cu. ft. per day. Hole had been drilled to 11,643 ft.

Magnolia, the operator, opened the field in February 1955. Nine holes have been drilled. Three have been dry, and six productive. The area is 10 miles southwest of Sabine Pass, and about 8 miles offshore.

SOUTHEASTERN STATES

MISSISSIPPI

Wilcox Production Opened In Two More Discoveries

H. L. Rowley, Inc., has a new Wilcox discovery in northern Wilkinson County, where its 1 McCarstle and others, in 25-4n-2w, has been completed good for 111 bbl. of 36.5°-gravity oil per day through ⅛-in. choke. Flow was with pressure of 475 psi. Its pay is in the Armstrong zone, perforated at 6,890-6,904 ft. Hole was drilled to 7,513 ft.

The discovery is designated as Doloroso field, named after a nearby small town. It is about 4 miles southeast of Possum Corner field, nearest other production.

This is the second Wilcox discovery in southwestern Mississippi within 2 weeks. The other, in western Jefferson County, was by Jett Drilling Co. and Robert Oil Co. at their 1 Lisbony Unit, in 26-9n-2w. It was productive from the Artman zone, perforated at 5,435-37½ ft., with a potential rating of 99 bbl. of 41.5°-gravity oil per day through ⅛-in. choke. It has been named for the nearby Reeves school.

WESTERN CANADA

SASKATCHEWAN

Southeast Report

Imperial Oil, Ltd., released details on another three wildcats in southeast Saskatchewan which have indicated oil success recently. One of the new wells lies in Poplar area, 4 miles south of Glen Ewen and 42 miles east of Estevan, while the other two lie in the general Oxbow area, 12 miles southeast of production in Frobisher field. The new strike in the Poplar area, Imperial 3-25 Poplar, indicated commercial success when oil flowed to the surface from the Charles zone. One of the wells near Oxbow townsite, Imperial 3-14 Oxbow, also tested the Charles zone for its oil showings while the other hole in the same area, Imperial 9-5 Goldridge, encountered porosity in the Mission Canyon horizon.

Imperial 3-25 Poplar, is on LSD 3, 25-2-1w2, is 2 miles southeast of the company's 13-25 Poplar Charles zone oil success and 2¾ miles west of the Imperial 15-22 Florence Mission Canyon zone oil discovery well. The discovery horizon was contacted around the 4,250-ft. mark and a full stand of oil was recovered from the drill pipe when it was pulled, following the drill-stem test.

The Imperial 3-14 Oxbow strike on LSD 3, 14-3-2w2, encountered the Charles at 4,271 ft. and two drill-stem tests were made. Pipe recoveries showed up to 450 ft. of clean oil with small amounts of salt water.

The other strike, Imperial 9-5 Goldridge, LSD 9, 5-4-2w2, had five drill-stem tests reported on it, with two in the Charles zone giving up only mud recoveries. Of the three tests reported in the Mission Canyon, the initial one had the best recovery, giving up 180 ft. of gassy mud, 230 ft. of frothy muddy oil and 10 ft. of sulfurous salty water.

All of the wells have reached total

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depth and are currently standing waiting on service rigs to carry out further evaluation work.

• Imperial Oil, Ltd. has scored another indicated discovery in the southeastern region of Saskatchewan. This time the success was Imperial-New Gas-Poplar Admiral et al 8-14 Queensville.

Initial drill-stem test yielded over 600 ft. of clean oil and subsequent tests flowed light gravity crude oil to surface. The well is 11 miles northwest of Alida oil field, 19 miles northeast of the Midale medium gravity crude oil producing area.

Sample top of the Mission Canyon at 8-14 Queensville was picked at 3,936 ft. and K.B. elevation at the well site is 1,966 ft. Initial drill-stem test was run of the interval 3,934 to 3,950 ft., with valve open 60 minutes. Gas flowed to surface in 4 minutes at rate of 196 M.c.f. and oil sprayed to surface in 10 minutes. When pipe was pulled it contained 630 ft. of clean oil that graded 36.6°, and 280 ft. of mud-cut oil.

The second test was run of interval 3,950 to 3,960 ft. with valve open 15 minutes. Gas surfaced in 4 minutes at the rate of 380,000 cu. ft. daily. Oil sprayed to surface in 9 minutes and it was graded 36.7°. The pipe recovery showed 420 ft. of clean oil. The last completed test was run of the interval 3,960 to 3,970 ft. with the valve open 20 minutes. Gas was measured at surface in 4 minutes at 372,000 cu. ft. daily and oil flowed to surface in 12 minutes. Gravity was 34.8° with a cut of 1.6 per cent B.S. The pipe recovery was 1,020 ft. of clean oil.

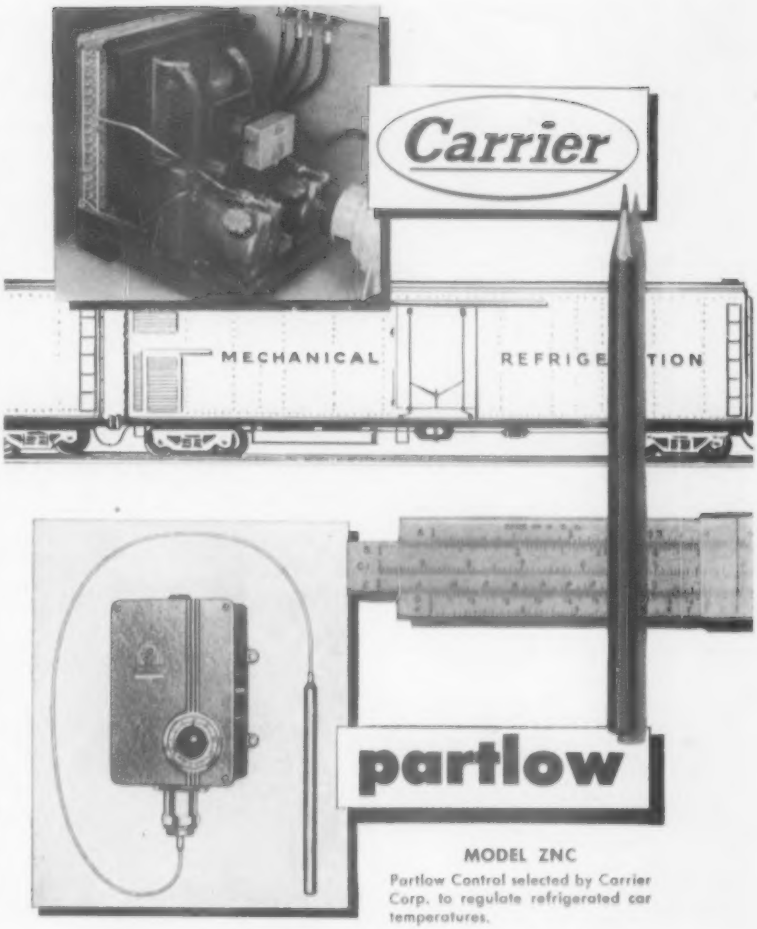
ALBERTA

Eagle Hill Discovery Flows 732 Bbl. Per Day

Another prolific addition to the Sundre-Westward Ho trend in southwestern Alberta was made last week by Hudson's Bay Oil & Gas Co., Ltd. The 1 Eagle Hill wildcat was placed on production in the Mississippian with an initial potential of 732 bbl. of oil per day.

Location of the new well is on LSD 7, 30-33-4w5, 2 miles north of Westward-Ho field, and 3 miles east of the south end of Sundre field. Perforations were at 8,908-48 ft.

• It was reported by the Banff Oil, Ltd., that two drill-stem tests in the D3 zone of Devonian at the Banff-Canadian Seaboard 7-3 Wimborne well have been completed. The tests flowed gas at rates estimated as high as 20,000 M.c.f. and five pipe recoveries of distillate with no evidence of formation water. The D3 formation was topped



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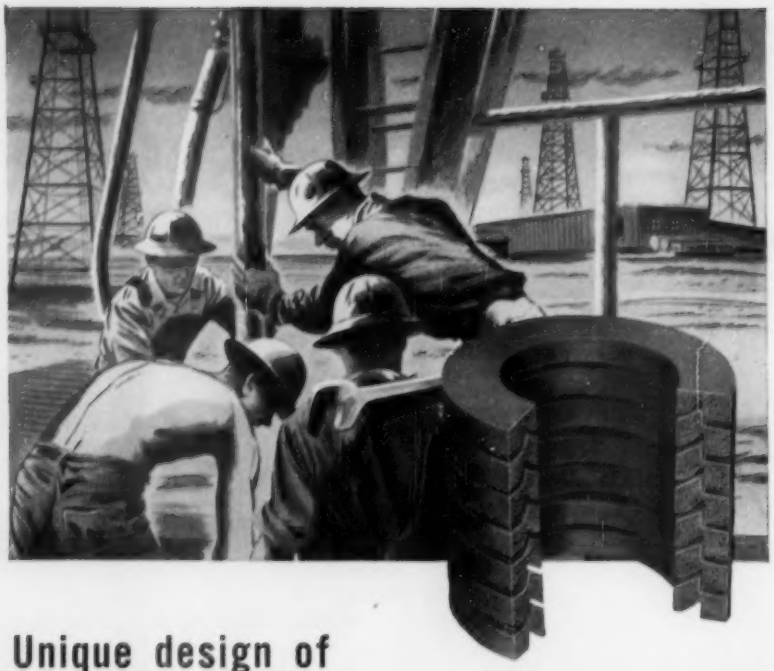

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at 7,480 ft. (K.B. elevation 3,255 ft.) as subsea elevation of 4,255 ft., about 9 ft. lower than Banff 4-1 Wimborne completed potential gas producer. The 7-3 Wimborne well is being drilled by Banff and Canadian Seaboard Oil Co. and associated on a full section farmout acquired from the Calgary and Edmonton Corp. It is 1½ miles west and ¼ mile north of Banff's 4-1 Wimborne gas well.

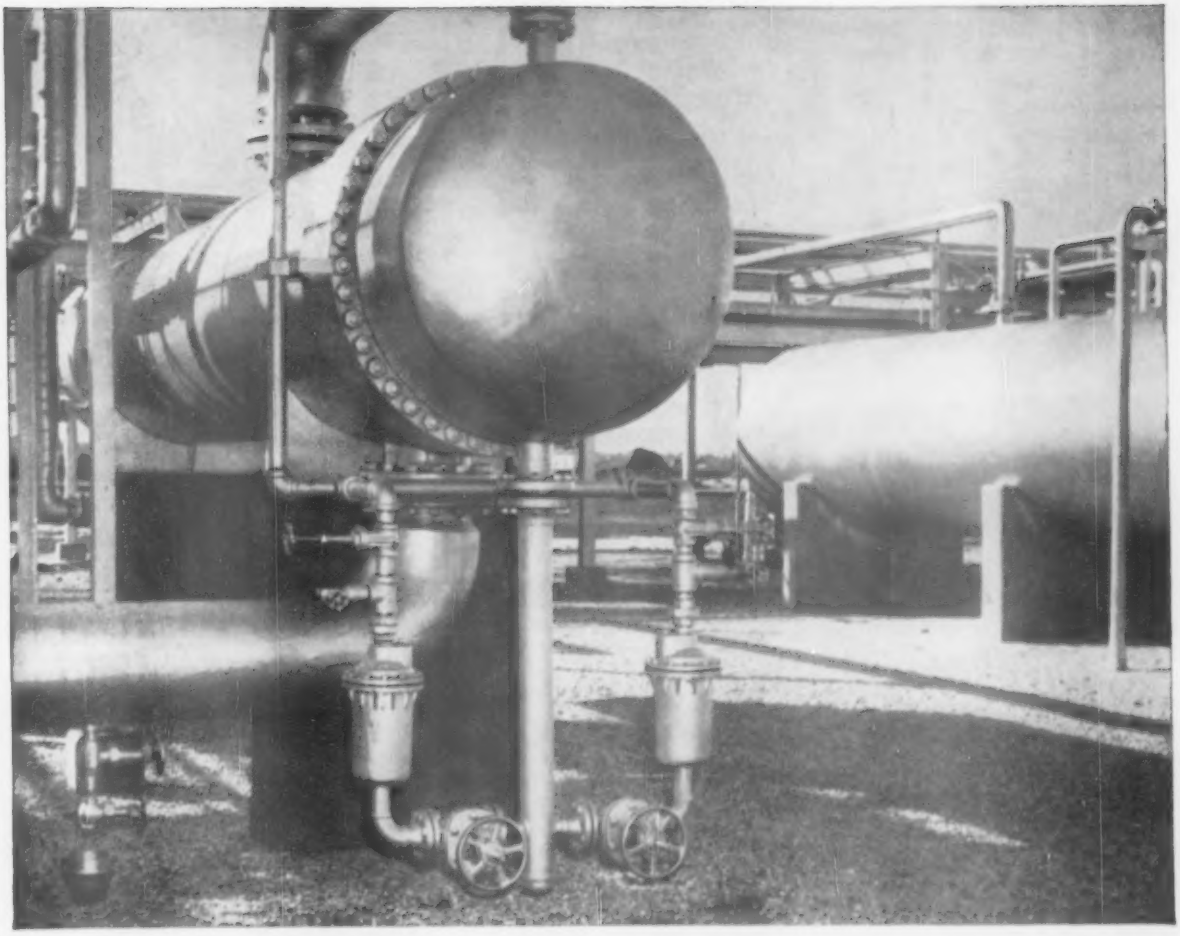
The third drill-stem test run of the interval 7,545 to 7,557 ft. at the Banff 7-3 Wimborne well flowed condensate and oil to surface. A gas flow of 8,000 M.c.f. was also recorded and when the pipe was pulled it contained 465 ft. of clean oil and 200 ft. of gas-cut mud. Gas flowed to surface in 13 minutes and condensate and oil reached the surface in 16 minutes.

• Gridoil Freehold Leases, Ltd.'s 10-35 Manor exploratory venture yielded an encouraging oil show during initial drill-stem test. Nearest producer to this southeastern Saskatchewan wildcat is the 6-26 Knight discovery well and Alida oil field lies about 12 miles south.

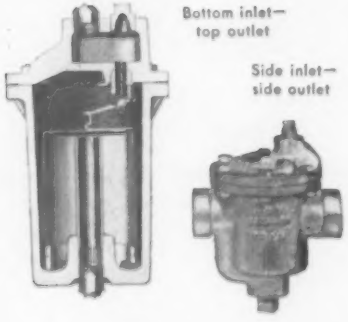
Top of the Mission Canyon pay was not reported but Gridoil officials reported that the well found a gross pay thickness of about 10 ft. in that horizon. Initial drill-stem test was run from 3,761 to 3,782 ft. with valve open 60 minutes. The pipe contained 315 ft. of fluid when it was pulled, including 125 ft. of oil-cut mud and 190 ft. of mud-cut oil. Second drill-stem test of the interval 3,781 ft. to 3,792 ft., also 1 hour in duration yielded a pipe recovery of 150 ft. of sulfurous salt water. The test is bottomed at 3,900 ft.

• Canadian Oil Companies, Ltd. set string of production casing at its 4-15 West Roughbark wildcat in the Weyburn district of southwestern Saskatchewan to further test an encouraging oil show recorded during drill-stem test in the Charles section of the Mississippian. This test is 13 miltes south of the town of Weyburn and it is 5 miles southwest of the main development sector of Weyburn oil field.

Whiterose - Canadian Superior 4-5 West Roughbark topped the Charles horizon at 4,610 ft. (K.B. elevation 1,932 ft.) was carried to completion depth of 5,000 ft., after testing the Charles section. Test that yielded sufficient encouragement to warrant setting casing was run of the interval 4,660 to 4,694 ft. During the 120 minutes that valve was open a small air blow was recorded and when pipe was pulled it contained 30 ft. of oil-cut mud, 90 ft. of heavily mud-cut oil and 30 ft. of mud-cut water. Operator plugged the well back to 4,800 ft. from total depth well back to 4,800 ft. from total depth.



A Look at Low Cost Maintenance . . .



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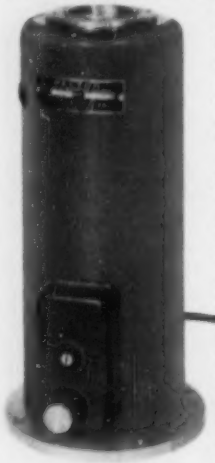

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• Christie Mitchell and Mitchell has run production casing at its wildcat venture south of the Okotoks gas producing area of southern Alberta. Some drill-stem tests were run prior to setting the production casing but results of the tests have not been released by the operator. The company plans to production test as soon as possible to evaluate the Crossfield section of the Devonian in which the well is bottomed. The company plans also to run tests in higher formations. The well is bottomed at 9,130 ft. and 7-in. casing was landed at 8,999 ft.

BRITISH COLUMBIA

Rank Test Announced Near Fort Nelson

Gulf States Oil Co. of Canada, Union Oil Co. of California, Ltd., Hudson's Bay Oil & Gas Co., Ltd., and El Paso Natural Gas Co. will drill a wildcat in the Prophet River area of northeastern British Columbia, 16 miles northwest of Klua Creek field and 7 miles southwest of Fort Nelson town. This new try will go to the Devonian at about 8,000 ft.

Successful Wildcats

CALIFORNIA

San Mateo County: Neaves Petroleum Development Corp. 2 Neaves-Union Oil-Lane, NW SE 17-7s-4w, BOPD 75, 40° gravity, 7 per cent cut, 8/64-in. choke, TD 1,763 ft. (New field discovery in LaHonda region).

Orange County: Shell Oil Co. 24-19 Dominguez, SW NW 19-3s-8w, 90 BOPD, 26.8° gravity, 6 per cent cut, TD 5,000 ft. (New fault block discovery in southeast Whittier field).

SOUTHEAST NEW MEXICO

Eddy County: El Paso Natural Gas Co. 1-X Welch Unit, 21-26s-27e, IP 27,000 M.c.f. gas, various size chokes, Pennsylvanian (?) pay 12,502-22 ft. TD 12,620 ft., PB 12,564 ft.

WEST TEXAS

Gaines County: Headwaters Oil Co. 1 Jones, 59-AX-PSL, 15 mi. NW Seminole. IPP 88 BOPD, 36°, GOR 520, San Andres 4,933-66 ft. TD 4,982 ft.

Irion County: Phillips Petroleum Co. 1-A Nutt, L&SV Sur., A-463, 2 mi. NW Mertzon. IPP 108 BOPD, 36.9°, GOR 218, Wichita Albany 3,412-30 ft. TD 6,700 ft.

Sinclair Oil & Gas Co. 2 E. J. Cox, 46-14-H&TC, 17 mi. W Mertzon. IPP 87 BOPD, 31°, GOR 934, Spraberry 4,682-92 ft. TD 4,734 ft.

Stanolind Oil & Gas Co. 1-B Sugg, 19-6-H&TC, 12 mi. NW Mertzon. IP 79 BOPD, 24/64-in., TP 220 psi., 38°, GOR 24,649:1, Canyon sand 6,385-95 ft. TD 6,577 ft.

Tucker Drilling Co. 1 Sugg, Sec. 1893, B. Verbena Sur., 10 mi. NW Mertzon. IPP 79 BOPD, 34°, GOR 326, Wolfcamp 5,535-55 ft. TD 5,972 ft.

Loving County: Hill & Meeker 1 Johnson,

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48-54-T1-T&P, 11 mi. N Mentone. IP 23 BOPD, 48/64-in., 36°, GOR 1860, Delaware sand 4,505-15 ft. TD 4,515 ft. Suggested new field name, Grice.

NORTH TEXAS

Wise County: A. R. Dillard 1 Mansfield, Blk. 8, M. H. Reid Sur., 5 mi. W Park Springs. IP 258 M.c.f. gas, conglomerate pay 5,793½ ft. TD 6,215 ft. Shut-in pressure 1,905 psi.

Young County: F. D. Mueller 1 Askew, J. J. Greenwade Sur., A-2136, Blk. 15, 9½ mi. S Graham. IPP 31 BOPD, 39°, GOR 250, pay 2,519-24 ft. TD 2,740 ft.

WEST CENTRAL TEXAS

Fisher County: U. S. Smelting, Refining & Mining Co. 1 Foreman, A. B. Collins Tract, Subd. 34, Bastrop CSL, 6 mi. N Roby. IPP 183 BOPD, 40°, GOR 800, Lower Cisco sand 4,462 ft. TD 5,090 ft. PB 4,800 ft.

Shakelford County: Jones & Stasney 2 Dawson & Conway, Sec. 164, ETRR Sur., 19 mi. NW Albany. IP 96 BOPD, 16/64-in., TP 65 psi., GOR 375, 37°, Tannehill sand 1,375-81 ft., TD 1,675 ft.

NEW MEXICO

San Juan County: Forest Oil Corp. 1 Federal, C NE NE 13-24n-10w. IPP 120 BOPD, Gallup sand discovery, new field. TD 5,600 ft. Gallup sand.

NEBRASKA

Kimball County: Lowell J. Williamson 1 Vowers, C NW SW 21-14n-55w. IPP 100 BOPD, "J" sand discovery, new field. TD 6,350 ft. "J" sand.

1 Travis, C NW NW 12-16n-55w. IPP 66 BOPD, 45 BWPD, "J" sand discovery, new field. TD 6,119 ft. "J" sand.

UTAH

San Juan County: Western Natural Gas Co. et al 7 English-Tribal, NE NW 16-43s-22e. IPP 16 BOPD, 36 BWPD, Paradox discovery, new field. TD 5,409 ft. Leadville.

Uintah County: Havenstrie Oil Co. 83X-9H Unit, NE SE NE 9-10s-22e. IP 1,500 M.c.f. of gas per day, Wasatch discovery, new field. TD 5,404 ft. Wasatch.

Sky-Hi-Oil Co. 1 Oil Springs, NW SE 14-12s-24e. IP 180 M.c.f. of gas per day, 24 BWPD, Mesaverde descovery, new field. TD 5,270 ft. Mancos.

WYOMING

Natrona County: Delta Drilling Co. et al 1 Government, C NE NW 6-31n-84w. IPP 225 BOPD, Muddy discovery, new field. TD 6,361 ft. Morrison.

COLORADO

Mesa County: American Metals Co. 1 Government-Lavington, C SW SE 29-8s-104w. IP 4,260 M.c.f. of gas per day, Morison discovery, new pay. TD 3,040 ft. Salt Wash.

MISSISSIPPI

Wilkinson County: H. L. Rowley, Inc., 1 McCarstle et al, 25-4n-2w. IP 111 BOPD, ⅛-in., 36.5°, perforations 6,890-91 ft. (Wilcox-Armstrong sand). TD 7,513 ft. Elev. 264 ft., Wilcox 5,080 ft., base Baker shale 6,842 ft. (New field. Doloroso).

TEXAS GULF COAST

San Patricio County: Reynolds Mining Corp. 1 Ragsdale heirs, John F. Gravis Sur., A-137. IP 43,000 M.c.f. daily, open-flow potential, perforations 2,457-62 ft. TD 2,464 ft. (New field.)

Wharton County: Salt Dome Production Co. 1 Mitchell et al, Charles E. Hodson Sur. 18, A-462. IPP 6.77 BOPD, 29.5°, water 12 per cent, perforations 6,336-41 ft. TD 7,158 ft. (New field—2 miles northwest of South Lizzie field.)

LOUISIANA GULF COAST

Calcasieu Parish: Michel T. Halbouty 1 Lutcher-Moore, 10-8s-11w. IP 48 BOPD and 2,000 M.c.f. daily, ¼-in., 35°, perforations 6,494-97 ft. TD 7,300 ft. (New pay in DeQuincy field.)

Lafourche Parish: Monterey Oil Co. 1 Bowie, 116-15s-18e. IP 391 BOPD and 1,025 M.c.f. daily, 7/64-in., 52°, perforations 12,701-12 ft. TD 12,825 ft. (New reservoir 2 miles northwest of Raceland field.)

St. Mary Parish: Shell Oil Co. 4 OCS 0443, Block 128, Eugene Island area, Gulf of Mexico. IP 378 BOPD, 9/64-in., 35.9°, GOR 481 cu. ft. per bbl., perforations 10,497-10,511 ft. TD 11,692 ft. (Extension and new reservoir in Eugene Island Block 128 field.)

Terrebonne Parish: Tidewater Oil Co. 2 Braussard, 5-24s-20e. IP 2,747 M.c.f. daily with condensate spray, 3/16-in., 49.1° (fluid gravity), perforations 10,590-92 ft. TD 10,982 ft. (New pay in Caillou Island southeast extension field.)

SOUTHWEST TEXAS

Frio County: Security Drilling Co. 1 Pickens, Austin Williams Sur. 964, A-10. IPP 110 BOPD, 45°, perforations 5,638-42 ft. TD 5,643 ft. (New field.)

Wilson County: George Parker 2 Hart, Simon and Juande Arocha Grant. IPP 10.65 BOPD, 16.8°, perforations 585-87 ft. (Reklaw). TD 587½ ft. (New field.)

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As Stanolind's top explorer . . .

. . . Yost Moves into Key Spot

JUST 21 years to the day after he became an employe of Stanolind Oil & Gas Co., F. R. Yost assumed the post of vice president, exploration.

It wasn't his first executive position, but the move did represent something of a change in his oil industry career. Heretofore primarily concerned with development and production, Yost now finds himself responsible for Stanolind's expanding exploration program.

It won't be a difficut adjustment, for the native of Beaumont, Tex., has literally learned the oil business from the ground up.

He got his introduction to the industry with the old Yount-Lee Oil Co., starting in 1933 after studying business administration at the University of Tulsa. When Stanolind acquired the Yount-Lee properties in 1935, Yost was one of the Y-L employes who moved over to the new owner's payroll.

On the way up . . . He spent a little over 4 years as rotary floorman and rotary driller at High Island, Big Hill, South Houston, and Hastings, all on the Texas Gulf Coast. He moved to Luby, near Corpus Christi, in 1939 as a driller and later became a tool pusher. Then the next year he began a 3-year stint at Greta, serving successively as farm boss, production foreman, and field superintendent.

For the following 8 months Yost was division industrial relations manager at Houston. He then spent 6 months in Florida, supervising the drilling of two wells, before moving to Tulsa in mid-1944 as a district superintendent in the Central division. In September of 1945, he became assistant operating superintendent of the producing department, taking over as operating superintendent in May of 1947. Named manager of the production department early in 1949, he later that same year was elected to the board of directors.

In January, 1952, Yost returned to the Gulf Coast area he knows so well to take over as manager of the active Texas-Louisiana Gulf Coast division, headquartered at Houston. Eighteen months later, he was elected a vice president of the company, continuing as division manager.

Back to Tulsa . . . Now back in Tulsa, "Randy" and his wife Katherine are busy settling their new home and picking up the thread of activities they left behind nearly 5 years ago. Two of their three children are in school in Tulsa: John is a freshman at Cascia Hall, and

Sally has entered Holland Hall. The eldest, Randolph, Jr., is taking his sophomore year at St. Stephen's Prep school in Austin.

A hunter and fisherman, Yost also used to play golf, but no longer has the time. His new job may not leave much time for any avocational pursuits, for Stanolind's exploratory activity is moving forward on many fronts, and Yost can look chiefly to logging many more hours of air time in the years to come.

M. A. Jenkins, Jr., geologist with Pubco Development Co., has joined St. Helens Petroleum Corp., Ltd., Los Angeles. **M. D. Picard,** formerly geologist with Shell Oil Co., has also joined St. Helens.

Ralph Will, Calgary, has resigned as director and vice president of Souris Valley Oil Co., Ltd. Elected directors of the company are **H. G. Bagnall,** Calgary; **H. L. Carnahan,** Slidell, La.; **D. D. Ewart,** Montreal; **R. W. Kelly,** Winnipeg; **W. M. Luthy,** Calgary; **H. S. Scarth,** Winnipeg; **E. G. Smith,** Montreal.

Guido O. Grady, research engineer in the Tulsa laboratory of Cities Service Research & Development Co., has been promoted to technical group supervisor in charge of well mechanics section. **Jack A. King,** research chemist, has been named technical group leader in charge of the production chemistry group, and **Dr. Bartholomew Nagy,** research geologist, has been appointed technical group supervisor in charge of the geophysical research group.

Personals

Bev D. Blackwood, roustabout with Humble Oil & Refining Co. in Bronte, Tex., has been promoted to junior petroleum engineer and transferred to Winters, Tex.

George G. Walton, senior geophysicist in Carter Oil Co.'s Tulsa exploration department, has been named a group leader in the geophysical research section at the company's Tulsa laboratory.

F. M. (Cappy) Ricks, vice president in charge of exploration for Midwest Oil Corp., Denver, has resigned.

Marvin L. Ratts has joined the technical staff of Shields Oil Producers in Russell, Kans. A graduate of Kansas State College, Ratts was formerly with Dowell Incorporated.

Richard D. Allen and **James R. Anklam,** junior development engineers with Shell Oil Co. in Los Angeles, have been promoted to development engineers and transferred to Salt Lake City.

Glen M. Webster, development engineer for Shell Oil Co., has been transferred from the Los Angeles area office to Ventura, Calif.

James F. Ralston, consulting geologist, and **H. Dean Jirrels,** formerly with Midstates Oil Corp., have formed a consulting firm in Wichita.

Arthur E. Ward, district foreman in Sinclair Oil & Gas Co.'s Nowata, Okla., division production department, has been transferred to Seminole, Okla.

Wilbur B. Harrison, president of Apex Petroleum Corp., Ltd., has been elected president of the California Stripper Well Association. He replaces **Victor L. Norman,** who has resigned.

E. Rue Thomas, formerly with Humble Oil & Refining Co., has joined Trunkline Gas Co. as superintendent of gas supply. Thomas holds a bachelor's degree in mechanical engineering from Rice Institute and an L.L.B. degree from South Texas College of Law.

Robert N. Johnson, operating foreman of the solvent and light-oil treating plants at Tidewater Oil Co.'s Associated, Calif., refinery, has been appointed chief technologist of the refinery. He replaces **Harold J. Maddock,** who has transferred to the company's electronic data processing study group.

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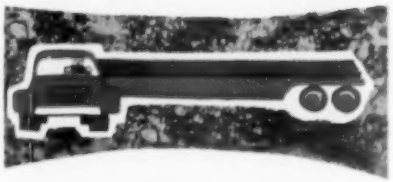

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Dick McCrehan, geologist for Phillips Petroleum Co. in New York, has been transferred to Evansville, Ind.

John Dawson, a graduate of Southern Illinois University, and **Don Patterson,** graduate of Monmouth College, have joined Ashland Drilling, Inc., at the company's Olney, Ill., office.

Michael P. Debaets, engineer in the gas measurement department of Ohio Fuel Gas Co., Columbus, Ohio, has been named assistant superintendent of the department.

W. T. Wells, Jr., assistant engineer with Tennessee Gas Transmission Co. in Midland, Tex., has been promoted to district engineer and transferred to Wichita Falls, Tex.

Frank B. Odasz, assistant director of technical service for Husky Oil Co., has been promoted to manager of development and control. A graduate of Polytechnic Institute of Brooklyn, Odasz was research engineer for Parmelee Motor Fuel Co. before joining Husky in 1947.

E. R. Turner, president of Pan American Production Co., has retired. Turner has been in the oil business 41 years. He joined The Texas Co. in 1915, later was assistant to the production vice president of Continental Oil Co. He joined Pan American in 1935. He has been president since 1947.

William E. Spear, division mechanical engineer in Shell Oil Co.'s Billings, Mont., division, has been named senior mechanical engineer in the Denver area production department. **Frank P. Van West,** division production geologist in the company's Midland, Tex., office, has been named production geologist in Denver, and **Frank A. Sikes,** district production foreman in Billings, has been transferred to the Denver area as mechanical engineer, production.

Dr. Harold E. Achilles, technical service supervisor of Tidewater Oil Co.'s research department, has been named assistant manufacturing coordinator in the company's New York divisional office. A number of appointments have been made at the company's new Delaware Flying A Refinery, near Wilmington. **C. A. Phillips** has beeen named supervisor of the desulfurization and hydrogen area. **Robert C. Harms** will be general coordinator of zone 1, and **George E. Rohrmann,** general coordinator of zone 3. **John J. Dudowicz** has been named electrical coordinator and **Samuel E. Roth,** instrumentation coordinator.

Earl E. Rose, chemical engineer for Phillips Petroleum Co., has been transferred from Borger, Tex., to Oklahoma City.

Earl L. Sherron has been named production foreman in Shell Oil Co.'s Billings, Mont., division.

Robert E. Wilson, chairman of the board of Standard Oil Co. (Ind.), has been appointed to the general advisory committee of the Atomic Energy Commission by President Eisenhower. Wilson's appointment runs through August 1962.

D. E. Powley, Calgary district geologist for Stanolind Oil & Gas Co., has been appointed division geologist. He replaces **R. O. Mitchell,** who has been transferred to Tulsa. **M. R. Waller,** area geologist in the company's North Canadian district, has been named Calgary district geologist replacing Powley.

Dr. Paul D. Torrey has been appointed lecturer in petroleum engineering at the University of Texas. Torrey is a noted authority on secondary recovery and is president of Orchem Corp., Austin. He heads several American Petroleum Institute committees and is secondary recovery committee chairman for the Interstate Oil Compact Commission.

R. Chamberlain, J. M. Pierce, John W. Agnew, J. D. Mason, and **Dr. P. C. Badgley** have been elected directors of Ranger Oil Co., Lusk, Wyo. Four former directors of the company have resigned. They are **Leon Henderson, John W. Meyer, Walter F. Riker,** and **Lowell M. Birrell.** Controlling interest in Ranger Oil was recently obtained by West Maygill Gas & Oil, Ltd., Calgary, from American Leduc Petroleums, Ltd.

A. W. Pratt, chief engineer in the process division for Stone & Webster Engineering Corp., has joined E. B. Badger & Sons, Ltd., affiliate of Stone & Webster in London, as engineering manager. **T. E. Casselman** will replace Pratt. **Dr. R. L. Geddes,** consultant in the process division, has been appointed a consulting engineer for the corporation.

S. J. Bell, R. O. Grimes, J. R. Maxwell, Guy Furgiuele, and **S. L. Newman** have been promoted to associates in the firm of H. E. Bovay, Jr., consulting engineers. Bell is head of design groups; Grimes, project engineer for industrial plants; Maxwell, head of piping design for oil and chemical industries. Furgiuele is air conditioning design director, and Newman, head of civil and structural design.

Personals

Bill G. Harper, chemist at Dow Chemical Co.'s Freeport, Tex., plants, has been promoted to research chemist.

Walter T. Herget, general superintendent of American Oil Co.'s Yorktown, Va., refinery, has been appointed manager of operations in the manufac-

W. T. HERGET

H. A. PARKER

turing department, New York. **H. A. Parker,** technical director of the company's Destrehan, La., refinery, has been named assistant manager of operations. Herget, a graduate of the University of Illinois, has been with American since 1942. Parker joined Standard Oil Co. (Ind.), parent company of American, in 1944 after graduating from Cornell University.

James L. Harden, exploration geologist for Ambassador Oil Corp. in Midland, Tex., has been transferred to Durango, Colo., as head of a newly opened district office there.

M. L. Moore, Jr., has been promoted by Sinclair Oil & Gas Co. to assistant district production foreman and transferred from Gainesville, Tex., to Lovington, N. M. **Charles C. Conrad** has been transferred from Gladewater, Tex., to Odessa, Tex., and promoted to assistant district production foreman.

J. R. Dungan, Jr., has been promoted by Lone Star Gas Co. from process engineer at the company's Dallas headquarters to assistant superintendent of gasoline plants for Lone Star and its subsidiary Lone Star Producing Co. **M. M. Martin** has been transferred from Tyler, Tex., to Dallas as process engineer replacing Dungan. **J. A. Bates,** formerly West Texas district superintendent of gasoline plants at Ranger, Tex., has been named departmental superintendent of the gasoline department, a newly created post. **W. A. Robinson** has been moved up to replace Bates and will supervise operations of gasoline plants at Gordon and Pueblo, Tex., plus those in the Ranger-Breckenridge area.

Personals

Doyle Reeves has joined Chemical Process Co. in Oklahoma City as geological engineer.

Joseph Adinoff, chief engineer for American Potash & Chemical Corp. in the company's Los Angeles plant, has been promoted to senior development engineer in Los Angeles.

Frank L. Lee, formerly assistant chief petroleum engineer for Union Pacific Railroad Co. at Los Angeles, has joined Petroleum Technologists, Inc., Montebello, Calif., consulting firm.

Darrell E. Smith, district geophysicist for Stanolind Oil & Gas Co. in Billings, Mont., has been transferred to the company's Salt Lake City district exploration office. A graduate of the University of Utah, Smith joined Stanolind in 1949.

Carl W. Ferris has been appointed manager of the new Chicago district of E. I. du Pont de Nemours & Co.'s petroleum chemicals division. Ferris is a mechanical engineering graduate of Cornell University. He joined Du Pont in 1947.

Pete Lindsay, mechanical superintendent at Esso Standard Oil Co.'s Baltimore refinery, has been named assistant to the general superintendent. **Jack Bannon,** mechanical superintendent at the company's Bayonne, N. J., refinery, will succeed Lindsay in Baltimore. **Eugene Lanier,** head of maintenance and construction at Baltimore, will replace Bannon as mechanical superintendent at Bayonne.

Bernard J. Clarke, supervisory engineer for Columbia Gas System Service Corp., has been promoted to chief supervisory engineer in the engineering and research department, New York. **William C. Day,** supervisory engineer, has been appointed manager of the gas engineering department in Columbus, Ohio. Clarke has been with the company since 1952. Day joined the system in 1933.

Frank Devlin has been named district geologist in Albuquerque for Sunray Mid-Continent Oil Co. **Paul Hoovler** has been named district geologist for the company in Casper, Wyo. **Carl E. Davis,** district landman in Casper, has transferred to Tulsa as coordinator for federal and Indian lands. **J. K. Caskey,** of the Midland, Tex., office, will replace Davis in Casper.

Richard A. Wise has joined Sunray Mid-Continent Oil Co. as geologist in Denver.

George August, formerly with Arabian American Oil Co. at Dhahran, Saudi Arabia, has joined American Independent Oil Co. as field manager in the Neutral Zone. Prior to going to the Middle East, August was a petroleum engineer with the Long Beach Harbor department.

Murray B. Quigles, Jr., district petroleum engineer for Union Producing Co. in Jackson, Miss., has been promoted to assistant drilling and production superintendent and transferred to Houston. Quigles joined Union in 1946. He has been district petroleum engineer since 1955.

David D. Dyche, formerly assistant manager of Continental Oil Co.'s central region transportation department, has joined Petroleum Chemicals, Inc., an affiliate company, in New Orleans. **B. H. Hill,** of Conoco's Ponca City office, has moved to Oklahoma City to replace Dyche.

Charles Field, formerly with National Carbon Co., has joined American Potash & Chemical Corp. as formulations chemist, Los Angeles.

Ed Fritz, geophysicist with Pure Oil Co. in Billings, Mont., has been transferred to Oklahoma City.

H. L. Swords has been transferred from Union Oil Co.'s West Texas division, to Denver as chief geologist of the company's Rocky Mountain division. He succeeds **Hanford Drummond,** who has resigned.

Ben I. Routh, manager of Rice Engineering & Operating, Inc., Great Bend, Kans., has been named vice president of Redwater Salt Water Disposal Co., Ltd., Edmonton. Rice Engineering has made an agreement with the Canadian company to manage and operate its salt-water disposal system. **E. Hochhausen,** formerly manager of Redwater Water Disposal Co., Ltd., has been appointed vice president of the company and general manager of Canadian operations. **L. A. Hunter** has been named secretary-treasurer.

DEATHS

Joe C. McConnico, 49, Oklahoma City petroleum consultant, died November 5 in Oklahoma City. McConnico was general superintendent and director of purchases for Pepper Refining Co. until 1954 when it was acquired by Chicago Corp. He was previously with Gypsy Oil Co., Cosden Oil & Gas Co., and Carter Oil Co. as petroleum engineer.

George G. Todd, 47, independent oil operator of Dallas and Midland, Tex., died in Dallas recently. He was formerly with Humble Oil & Refining Co. and founded Columbia Oil & Gas Co. and Todd Drilling Co. He later sold these concerns and founded Dal-Port Oil Corp., Dallas and Midland, which he headed as vice president and general manager until his death.

George Culver and **Steve Sekulich,** both Newcastle, Wyo., oil men, were killed recently when their light plane crashed while they were returning to Newcastle from a business trip to Billings, Mont.

Harry A. Potter, 63, one time chief gager for Gulf Oil Corp., died November 4 in Sacramento, Calif.

James Merrill Cobb, 64, retired oil scout with Gulf Oil Corp., died October 29 in Sapulpa, Okla.

W. H. McFadden, 87, chairman of the board of Southland Royalty Co., died November 1 in Fort Worth. McFadden was active in the oil and steel industries, in finance and philanthropy. He entered the oil business in 1909 in Oklahoma, serving as vice president of Kay County Gas Co., vice president of Marland Refining Co., and an executive of Marland Oil Co. A former mayor of Ponca City, Okla., McFadden was named to the Oklahoma Hall of Fame in 1935 in recognition of his philanthropic work.

William Cochran Woolf, 76, Shreveport drilling contractor and independent operator, died November 1 in Shreveport. Woolf entered the oil industry in 1911 with operations in Beaumont's Spindletop field.

Vere B. Mealy, 60, Guthrie, Okla., formerly supervisor for Zephyr Drilling Co., died November 2 in Oklahoma City.

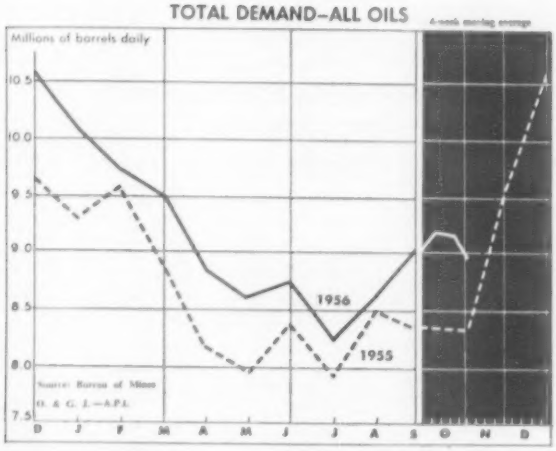
James Lloyd White, 59, senior oil and gas engineer for the State of California, died October 26 in Bakersfield, Calif.

Frank H. Thorne, chairman of Visco Products Co., Inc., Houston, and vice chairman of National Aluminate Corp., Chicago, died recently in Riverside, Ill.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,004,300	UP	1,675	UP	45,108
Crude stocks	283,608,000	UP	2,051,000	UP	26,094,000
Completions	1,056	UP	15	DOWN	77
Refinery runs	7,853,000	UP	183,000	UP	292,000
Gasoline stocks	172,626,000	UP	641,000	UP	20,622,000
Kerosine stocks	35,235,000	UP	717,000	DOWN	1,209,000
Distillate stocks	158,685,000	UP	1,417,000	UP	6,697,000
Residual stocks	48,071,000	UP	578,000	UP	2,139,000
Four-product stocks	414,617,000	UP	3,353,000	UP	28,249,000
Total imports	1,476,700	DOWN	70,500	UP	200,300



War and Weather Change Distillate Prices—But in Opposite Directions

WAR and weather have become the two most important factors influencing product markets in all areas east of the Rockies.

With the closing of the Suez Canal, European refiners started looking for new sources of supply. The first call was for crude either from the Gulf Coast areas of this country or from Venezuela. The high level of crude stocks in this country will promote early delivery.

Total crude inventories amounted to 283,608,000 bbl. on October 27, well above the normal working level. Crude stocks went to 290,800,000 bbl. during the refinery strike in 1953 and to 287,700,000 bbl. at the end of September 1953. The high points for 1954 and 1955 were 282,888,000 bbl. and 276,948,000 bbl. respectively. The average end-of-October crude stock level for the past 6 years has been about 271,000,000 bbl.

Operators could release at least 10,000,000 bbl. of crude from storage if the surplus were located near shipping points. Since the extra crude is scattered throughout refining and producing areas of the country, the volume immediately available at the Gulf Coast will be less than the over-all surplus. Some time will be required to change scheduled crude movements to deliver enough extra crude to cover increased export requirements at the Gulf Coast.

However, it will take time to reroute tankers to Gulf Coast ports from Middle East runs.

The refined product with the greatest stock surplus is the one near the bottom of the European shortage list. Since Europe has the refining capacity to meet its need for petroleum products, the first big demand on this country will be for crude. If requirements for crude cannot be met, European marketers will take refined products. The order of demand will be heavy fuel, light fuels, and then gasoline.

Export demand for both heavy and light fuels is tending to strengthen the Gulf Coast product market. No. 2 distillate fuel is up 0.25 cent a gallon, and heavy fuel is gaining strength.

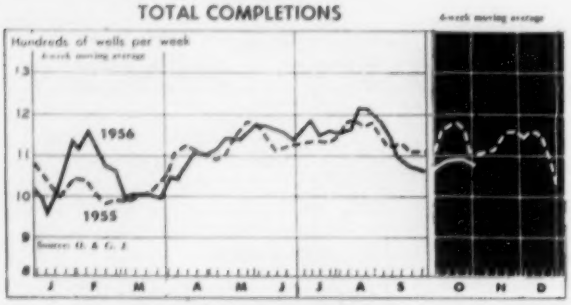
A secondary reaction to the trouble in the Middle East is causing increased demand from the East Coast. Some East Coast marketers have decided that distillate prices on the Gulf Coast certainly will not drop during the remaining weeks of the year and that there is a good chance that prices will be higher. Some have asked for November delivery on products that may not go to consumers until next month.

Mild weather in the last part of October put pressure on the Group 3 market for light fuels. The trend has been toward discounts to jobbers who buy on the spot market. Most of these jobbers are buying No. 2 fuel at 8.75 cents per gallon plus pipeline charges. This price represents a reduction of 0.25 cent a gallon.

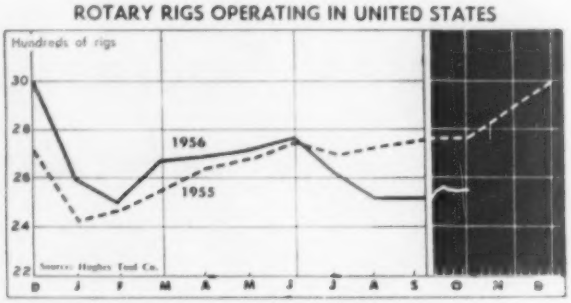
The high level of gasoline inventories also was a factor in the Group 3 drop in distillate prices. Unconfirmed reports indicate that some of the first discounts on distillate went to jobbers who also were large purchasers of gasoline. If gasoline prices of two suppliers are the same, the jobber will tend to place his gasoline business with the supplier who makes him a 0.25-cent lower price on distillate fuels.

Group 3 distillate prices will move back to at least 9.0 cents for No. 2 if the weather in the North Central area is cold enough to take surplus distillate off the market.

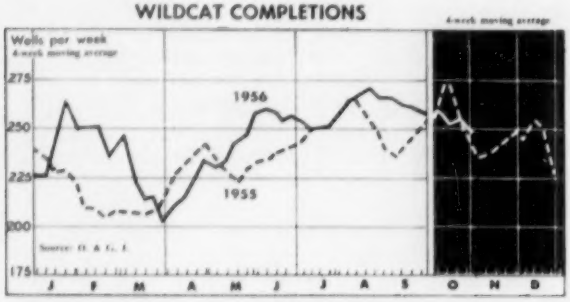
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	11-5-56	10-29-56	11-7-55
North Central and East	117	117	136
Southeast	41	40	37
Okla., Kans., Ark., Mo.	444	439	558
Louisiana	453	443	415
North and East Texas-Panhandle	384	376	425
Gulf and South Texas	235	239	255
West Texas-New Mexico	512	509	560
Rocky Mountain	243	266	295
Pacific Coast	113	108	142
Total United States	2,542	2,537	2,823
Western Canada	252	234	201

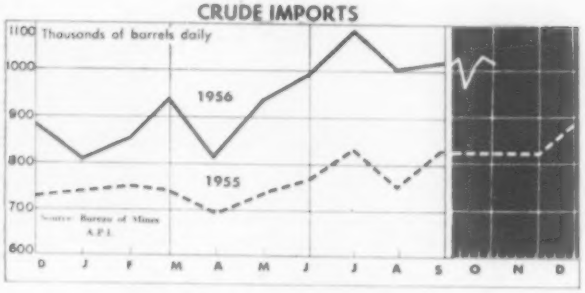
*Hughes Tool Co

WEEKLY WELL COMPLETIONS . . . WEEK ENDED NOVEMBER 3, 1956

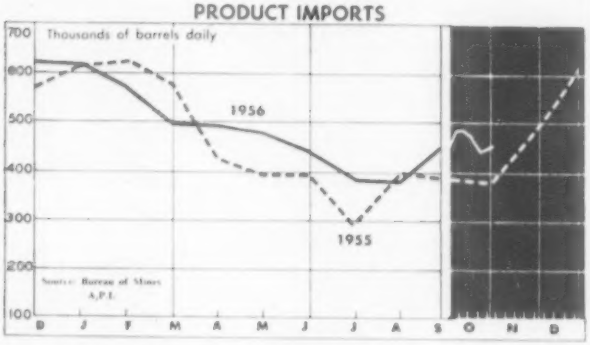
	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1956				
	Comp.	Oil	Gas	Dry	Footage	1956	1955	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	3	2	0	1	30,540	95	65	0	0	0	1	1	0	0	1	41	42
Arkansas	29	20	2	7	89,159	794	684	1	0	2	2	5	30	0	7	123	160
California	43	34	2	7	168,413	1,859	2,066	2	0	0	5	7	45	0	9	379	433
Colorado	31	11	3	17	155,184	1,016	1,269	2	0	1	15	18	24	0	14	507	545
Illinois	64	23	0	41	153,211	3,320	3,279	0	0	0	11	11	43	0	3	595	641
Indiana	18	6	1	11	24,695	586	611	1	0	0	2	3	16	0	1	103	120
Kansas	95	46	10	*39	334,190	4,205	4,250	4	1	0	16	21	107	4	35	768	914
Kentucky	40	14	5	†21	58,813	1,603	1,325	0	0	0	11	11	36	0	1	336	373
Louisiana	50	26	11	13	362,628	3,206	3,410	4	0	2	5	11	100	48	52	447	647
North	21	11	3	7	74,891	1,416	1,764	2	0	0	4	6	28	2	3	186	219
South	25	13	7	5	243,075	1,450	1,646	1	0	2	1	4	58	40	36	230	364
Offshore	4	2	1	1	44,662	340		1	0	0	0	1	14	6	13	31	64
Michigan	10	6	0	4	25,905	376	455	0	0	0	1	1	9	0	2	133	144
Mississippi	9	3	0	6	76,987	374	384	1	0	0	4	5	15	1	1	165	182
Montana	14	5	0	9	67,687	394	341	1	0	0	7	8	11	0	1	136	148
Nebraska	13	4	0	9	75,757	810	744	0	0	0	8	8	33	0	1	369	403
New Mexico	45	17	14	14	185,222	1,616	1,435	0	0	1	7	8	45	1	9	174	229
Northwest	17	0	11	6	53,680	714	488	0	0	0	3	3	11	0	7	62	80
Southeast	28	17	3	8	131,542	902	947	0	0	1	4	5	34	1	2	112	149
North Dakota	8	6	0	2	62,450	225	219	0	0	0	2	2	8	0	0	59	67
Ohio	14	5	3	6	37,691	907	1,019	0	0	0	0	0	2	0	4	6	12
Oklahoma	115	68	5	42	417,982	6,994	7,170	3	0	2	7	12	109	18	34	581	742
Pennsylvania-New York	68	23	8	‡37	169,694	§957	1,285	0	0	1	6	7	0	0	13	17	30
Texas	341	234	15	92	1,584,115	18,591	17,053	18	0	1	61	80	644	31	165	3,905	4,745
Southwest (1 & 4)	49	28	4	17	200,052	2,658	2,638	5	0	1	14	20	117	6	59	743	925
Gulf Coast (2 & 3)	47	22	7	18	316,619	2,215	2,147	2	0	0	11	13	59	16	57	597	729
East (5 & 6)	12	5	0	7	72,433	976	832	0	0	0	6	6	14	2	6	332	354
N. Central (7-B & 9)	85	57	0	28	279,833	6,634	6,357	6	0	0	16	22	281	0	11	1,556	1,848
West (7-C & 8)	121	99	3	19	605,692	4,986	4,185	4	0	0	11	15	155	0	11	618	784
Panhandle (10)	27	23	1	3	109,486	1,122	894	1	0	0	3	4	18	7	21	59	105
Utah	5	2	0	3	18,307	105	79	0	0	0	3	3	6	0	4	53	63
West Virginia	15	1	11	3	40,659	582	547	0	0	1	0	1	0	0	11	9	20
Wyoming	26	12	4	10	109,298	750	772	1	0	0	9	10	15	0	10	205	230
Miscellaneous	0	0	0	0	0	71	57	0	0	0	0	0	4	0	0	60	64
Total United States	1,056	568	94	394	4,248,587	§49,301	48,519	38	1	11	183	233	1,302	103	378	9,171	10,954
Total previous week	1,041	528	80	433	4,135,333			34	2	16	218	270	1,264	102	367	8,988	10,721
Total Nov. 5, 1955	1,133	612	79	442	4,592,965			29	5	5	212	251	1,381	183	296	8,544	10,404
Cumulative 1956	49,301	26,554	3,459	19,288	198,323,647												
Western Canada	68	38	6	24	324,883	2,673											

Service wells included: *3, †1, ‡23. §Revised.

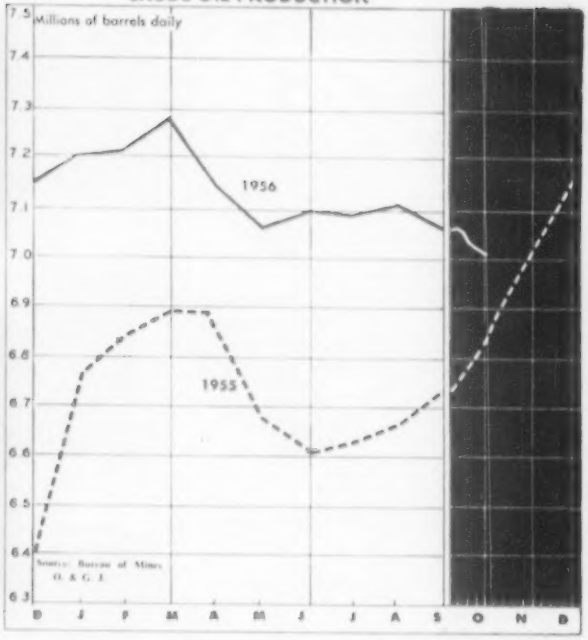
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

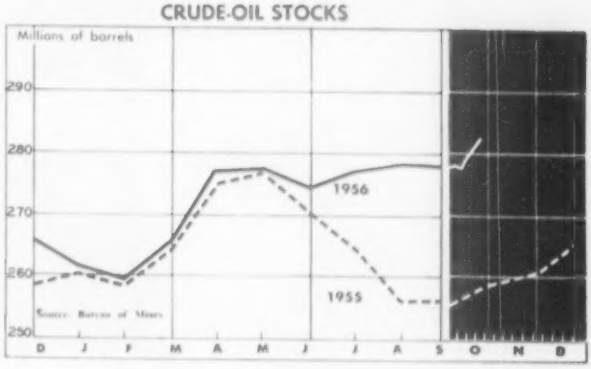


DAILY AVERAGE PRODUCTION FOR WEEK

	November 3, 1956			Oct. 27
	Crude oil	Lease condensate	Total	total
Alabama	11,200		11,200	10,000
Arkansas	77,750	350	78,100	77,700
California	957,100		957,100	955,200
Colorado	160,900		160,900	158,100
Eastern	50,400		50,400	50,800
Florida	1,275		1,275	1,375
Illinois	236,800		236,800	233,200
Indiana	32,000		32,000	30,500
Kansas	327,900		327,900	335,500
Kentucky	49,100		49,100	46,400
Louisiana	730,650	66,100	796,750	799,300
North	117,300	2,100	119,400	120,300
South	613,350	64,000	677,350	679,000
Michigan	26,400		26,400	26,800
Mississippi	108,950	5,000	113,950	113,650
Montana	61,400		61,400	61,400
Nebraska	37,900		37,900	38,700
Nevada	200		200	200
New Mexico	246,025	4,200	250,225	245,200
North Dakota	35,200		35,200	35,200
Oklahoma	†529,900		†529,900	†562,700
Texas	2,897,600	54,500	2,952,100	2,927,900
Dist. 1	56,275	550	56,825	56,500
Dist. 2	142,150	8,600	150,750	149,100
Dist. 3	412,000	26,000	438,000	434,500
Dist. 4	226,725	6,500	233,225	233,200
Dist. 5	40,425	450	40,875	41,450
Dist. 6	121,850	6,000	127,850	126,900
East Texas field	197,875		197,875	196,000
Dist. 7-B	157,150	45	157,195	158,050
Dist. 7-C	170,575	3,905	174,480	173,900
Dist. 8	1,059,000	1,600	1,060,600	1,044,600
Dist. 9	210,725	650	211,375	211,500
Dist. 10	102,850	200	103,050	102,200
Utah	7,800		7,800	5,100
Wyoming	287,600		287,600	287,600
Others	‡100		‡100	‡100
Total U. S.	6,874,150	130,150	**7,004,300**	7,002,625
Change from previous week, up			**1,675**	
Canada	†439,400		†439,400	†509,448
Total U. S. prod., January 1-November 3			2,195,080,950 bbl.	
Same period last year (crude plus cond.)			*2,073,732,081 bbl.	

*Includes 34,554,475 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

CRUDE-OIL STOCKS



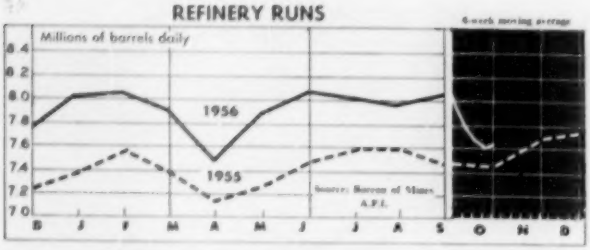
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

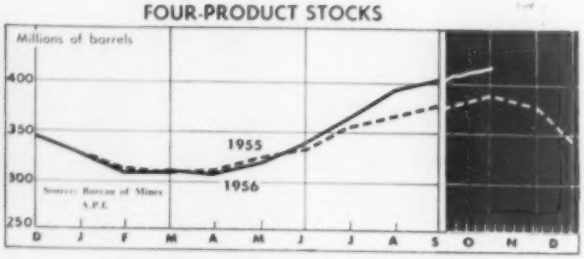
	10-27-56	10-20-56	10-29-55
Pennsylvania Grade	2,449	2,434	3,206
Other Appalachian	2,311	2,534	1,867
Illinois, Indiana, Michigan	11,143	11,012	9,401
Nebraska, North Dakota	2,311	2,568	2,574
Kansas	10,470	10,067	8,083
Oklahoma	25,162	24,747	20,932
Arkansas	2,934	2,870	2,328
Louisiana	17,397	17,467	15,913
North	2,734	2,632	2,483
South	14,663	14,835	13,430
Mississippi	3,010	2,948	3,057
New Mexico	9,155	9,148	7,305
Texas	128,303	127,181	121,838
East Texas proper	9,231	9,195	9,521
West Texas	63,219	62,158	57,190
Texas Gulf	23,976	23,876	25,505
Other Texas	31,877	31,952	29,622
Wyoming	16,890	16,970	14,808
Other Rocky Mountain	6,475	6,364	5,832
California	29,453	29,159	27,132
Foreign	16,145	16,088	13,238
Total	283,608	281,557	257,514

*Bureau of Mines. Includes 4,822,000 bbl. in California.

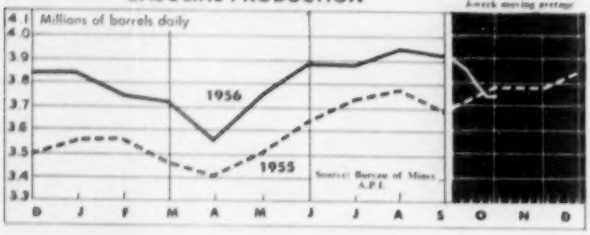
REFINERY RUNS



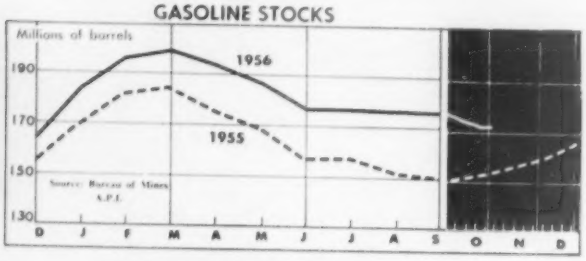
FOUR-PRODUCT STOCKS



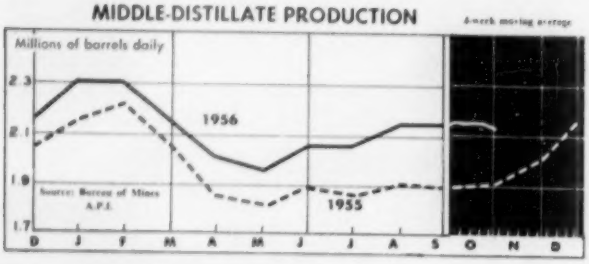
GASOLINE PRODUCTION



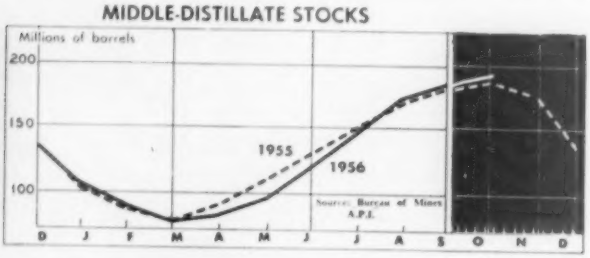
GASOLINE STOCKS



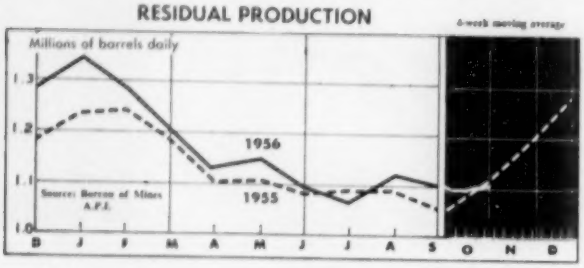
MIDDLE-DISTILLATE PRODUCTION



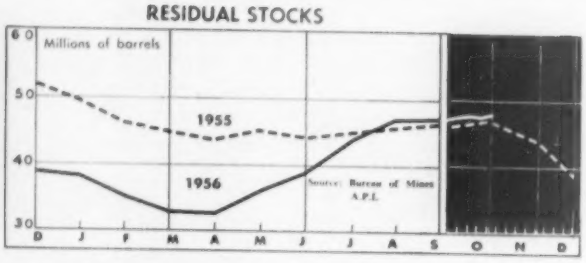
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, NOVEMBER 2, 1956

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, November 1955 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,192	438.3	32.0	339.7	189.0	41,997	14,439	60,432	12,750	1,102	428.0	27.6	267.4	222.9
Appalachian:														
District 1	108	42.7	4.7	27.4	9.7	4,211	636	3,630	478	112	46.1	5.5	21.1	8.2
District 2	80	42.3	4.0	14.0	12.1	2,599	729	999	312	91	50.7	3.8	18.1	12.5
Ind., Ill., Ky.	1,334	713.3	78.3	288.4	179.0	29,601	7,881	25,097	6,107	1,375	751.2	73.3	272.1	192.8
Minn., Wis., Dak.	87	46.2	8.9	21.3	4.9	6,649	1,732	8,624	114	(§)	(§)	(§)	(§)	(§)
Okla., Kans., Mo.	656	351.4	14.7	156.1	23.4	13,976	1,823	13,971	1,552	693	406.2	17.8	162.9	34.9
Inland Texas	270	200.4	6.4	51.9	22.0	7,652	630	2,102	1,852	251	186.8	9.8	47.2	19.0
Texas Gulf Coast	1,901	933.4	120.1	439.8	247.2	24,941	3,242	16,125	6,957	1,940	907.8	137.3	481.2	255.1
La. Gulf Coast	688	360.0	75.4	162.6	52.0	9,934	2,583	7,699	1,522	688	357.8	54.8	165.3	48.1
N. La. and Ark.	102	37.3	6.4	20.0	4.6	4,134	736	2,162	249	97	36.7	6.4	24.9	6.7
Rocky Mountain:														
New Mexico	23	12.1	0.6	4.3	3.9	470	13	184	40	22	11.0	0.4	3.9	2.6
Other Rocky Mtn.	256	121.6	1.9	57.3	34.4	4,682	417	3,275	909	256	122.8	4.3	62.0	42.3
California	1,156	503.9	4.7	199.6	337.1	21,780	374	14,385	15,229	1,065	482.7	...	153.7	368.6
Nov. 2, 1956	7,853	3,802.9	358.1	1,782.4	1,119.3	172,626	35,235	158,685	48,071	7,692	3,787.8	341.0	1,679.8	1,213.7
Oct. 26, 1956	7,670	3,704.4	382.9	1,769.9	1,106.0	171,985	34,518¶	157,268	47,493					
Nov. 4, 1955	7,561	3,776.1	330.1	1,670.1	1,153.7	152,004	36,444	151,988	45,932					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines. §Included in Indiana, Illinois, Kentucky district. ¶Revised.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (88 octane)	11.00-11.50
Premium (96 octane)	12.75-13.25
Gulf Coast (cargoes for coastwise or export movement):	
Regular (90 octane)	11.00-11.50
Regular (92 octane)	11.25-11.75
Premium (97 octane)	12.75-13.25
Premium (98 octane)	13.00-13.50
California—Los Angeles (rack):	
Regular (84 octane)	12.1-12.6
Premium (93 octane)	13.35
Premium (96 octane)	14.3-14.6
Caribbean area (cargoes):	
Regular (87 octane)	10.00
Premium (93 octane)	11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
★ Grade 26-70	4.5
Breckenridge:	
★ Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
★ Kerosine 42-44	9.75-10.00
★ Diesel oil (58 d.i. and above)	9.50-9.75
★ Distillate No. 1	9.375-9.625
★ Distillate No. 2	8.75-9.00
Gulf Coast (cargoes):	
Kerosine 41-43	9.5
★ Distillate No. 2	9.0
New York Harbor (barges):	
Kerosine 41-43	11.25
Distillate No. 2	10.65
Diesel fuel, 48-52 d.i.	10.95
Caribbean area (cargoes):	
★ Distillate No. 2	9.0

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.05-2.10
Gulf Coast (cargoes):	
Bunker C fuel	$2.10
New York Harbor (barges):	
Bunker C fuel	$2.80
Caribbean (cargoes):	
Bunker C at Aruba, N.W.I.	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.15-2.25

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	24
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.75
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	27
200 vis. neutral (180 at 100°), 25 p.t.	25

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.02				
15-15.9	2.08				
16-16.9	2.13				
17-17.9	2.19				
18-18.9	2.24				
19-19.9	2.30				
20-20.9	2.35	$2.50		$2.37	
21-21.9	2.41	2.52		2.39	
22-22.9	2.47	2.54		2.41	
23-23.9	2.52	2.56		2.43	
24-24.9	2.58	2.58	$3.01	2.45	
25-25.9	2.64	2.60	3.03	2.47	$2.13
26-26.9	2.69	2.62	3.05	2.49	2.19
27-27.9	2.76	2.64	3.07	2.51	2.24
28-28.9	2.83	2.66	3.09	2.53	2.29
29-29.9	2.91	2.68	3.11	2.55	2.34
30-30.9	2.97	2.70	3.13	2.57	2.39
31-31.9	3.04	2.72		2.59	2.44
32-32.9	3.12	2.74		2.61	2.48
33-33.9	3.20	2.76		2.63	2.52
34-34.9	3.27	2.78		2.65	2.56
35-35.9	3.34	2.80		2.67	2.60
36-36.9	3.39	2.82		2.69	2.64
37-37.9		2.84		2.71	2.66
38-38.9		2.86		2.73	2.68
39-39.9		2.88		2.75	2.70
40 and up		2.90		2.77	2.72

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas. †Low-cold-test Gulf Coast. ‡Sour.

Effective dates: California, February 7, 1956; east of California, June 15, 1953; Pennsylvania Grade, August 16, 1956.

Some crudes in North Central Texas, West Central Texas, and Texas Panhandle have been shifted to the intermediate schedule with $2.83 for 40° and 2 cents per degree drop. Effective dates range from July 15, 1956, to August 10, 1956.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	4.68
Middle District	4.50
Southwest Pennsylvania	4.21
West Virginia	4.03
Buckeye Grade	4.07
Zanesville Grade	3.15
Illinois Basin	2.90
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.60
Redwater (Alta.) D-3	2.49
Smiley-Viking (Sask.)	2.26
Fosterton (Sask.)	1.29
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.8°, Tucupido	*3.40
San Joaquin, 41°-41.9°, Puerto La Cruz	*3.04
Oficina, 35°-35.9°, Puerto La Cruz	$2.80
Tia Juana medium, 26.5°-26.9°, Amuay§	†2.30
Quiriquire, 16.5°-16.9°, Caripito	‡2.21
Lagunillas heavy, flat, Amuay or Las Piedras§	2.05
Bachaquero, 16.5°-16.9°, Amuay or Las Piedras§	‡1.90

*Plus or minus 2 cents per barrel for each degree gravity change. †Plus or minus 2.5 cents per barrel for each half-degree gravity change. ‡Plus or minus 3.5 cents per barrel for each half-degree gravity change. §Also available at La Salina at 3.0 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.46
Iraq, 36.0°-36.9°, Tripoli, Banias	2.46
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-U.S.N.H., clean (USMC+170%)	$7.70
★ Gulf-U.S.N.H., dirty (USMC +172.5%)	7.77
★ N.W.I.-U.S.N.H., dirty (USMC +165%)	7.16
★ N.W.I.-U.K., clean (Scale+275%) (121s. 11d.)	16.96
★ P.G.-U.K., dirty (Scale+325%) (229s. 10d.)	31.98

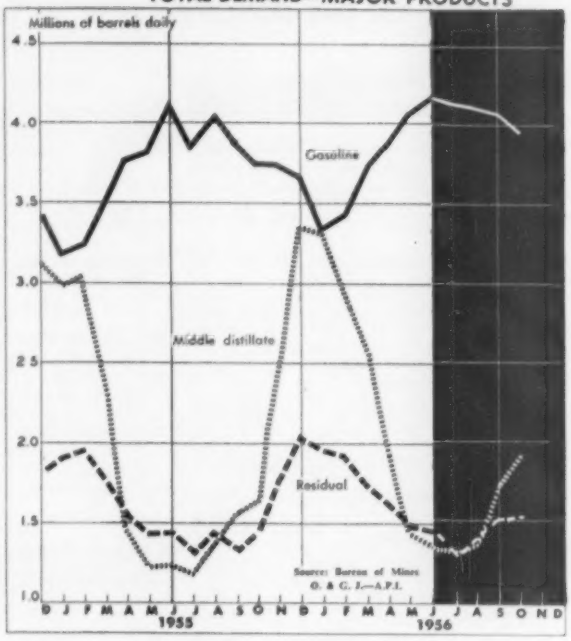
SUPPLY AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

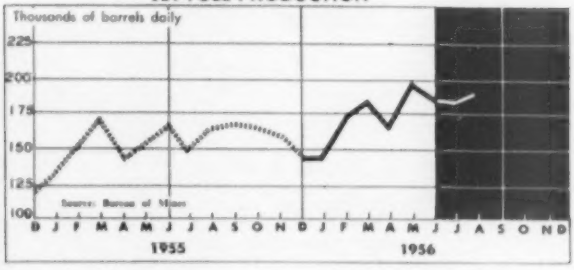
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
October 1956*	3,948	3,738	172,500
September 1956*	4,088	3,935	174,080
August 1956	4,166	3,922	172,939
November 1955	3,726	3,788	157,871
October 1955	3,740	3,766	153,103
KEROSINE			
October 1956*	328	352	35,100
September 1956*	287	336	33,870
August 1956	225	313	31,826
November 1955	455	341	33,283
October 1955	297	309	36,705
DISTILLATE			
October 1956*	1,581	1,787	158,500
September 1956*	1,426	1,814	150,810
August 1956	1,144	1,839	137,905
November 1955	2,047	1,680	141,808
October 1955	1,334	1,612	152,288
RESIDUAL			
October 1956*	1,521	1,104	48,000
September 1956*	1,508	1,102	47,400
August 1956	1,358	1,091	46,617
November 1955	1,773	1,214	44,071
October 1955	1,453	1,123	47,040

*Preliminary. †Thousands of barrels.

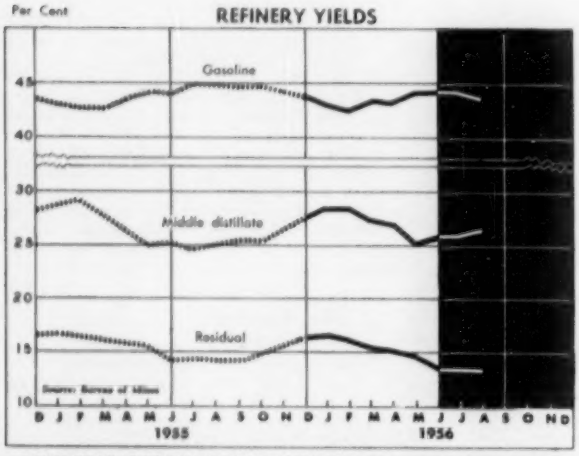
TOTAL DEMAND—MAJOR PRODUCTS



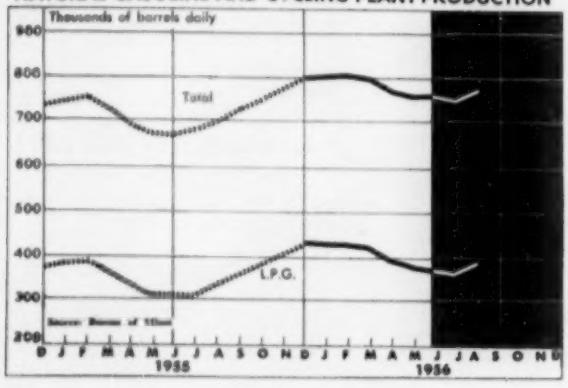
JET-FUEL PRODUCTION



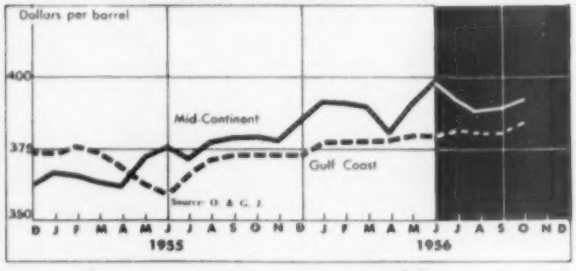
REFINERY YIELDS



NATURAL-GASOLINE AND CYCLING PLANT PRODUCTION



REFINERY REALIZATION



REFINERY REALIZATION

	Oct.* 1956	Sept.* 1956	Aug. 1956	Oct. 1955
Mid-Continent	$3.93	$3.88	$3.88	$3.79
Gulf Coast	3.85	3.81	3.81	3.73

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel oil, and residual as published in The Oil and Gas Journal.

Equipment Men

(Continued from page 260)

BJ Appoints in Oklahoma, Opens Edmonton Office

Delmar Linville has been assigned to sales duties in Duncan, Okla., for Byron Jackson Tools, Inc.; Richard Lynch will handle sales in Oklahoma City. Dan A. Harrington, Jr. has joined the company as a warehouseman in Oklahoma City. These appointments were announced by V. C. Horner, vice president and manager of sales.

Linville, Lynch, and Harrington are under the supervision of John Hankins, Oklahoma-Kansas district sales manager. Linville served as warehouseman for BJ Tools prior to this appointment. Lynch was formerly associated with Weatherford Oil Tools in sales work. Harrington previously held positions with Bovaird Supply Co. and Bowen Co.

The completion and formal opening of the Edmonton, Canada, warehouse and office of Byron Jackson Tools has been announced by Garth Nicolson, vice president and general manager. The office-warehouse, located on 1¼ acres of land, is under the direction of A. R. Boyd, district manager, and will serve as the Canadian supply point for BJ oil tools.

Mason-Neilan Names Gram As Sales Vice President

Carl W. Gram, Jr., has been named vice president in charge of sales for the Mason-Neilan Division of Worthington Corp., Norwood, Mass., according to an announcement by President F. Kenneth Morrison.

Gram joined the sales division of The Mason-Neilan Regulator Co. in 1937. In 1953 he was named manager of the petroleum and chemical-sales division, with headquarters in New York City. In this capacity he was responsible for sale of the complete line of Mason-Neilan instruments, control valves and regulators.

Franklin To Discuss Nomads With Venezuelan Oil Men

Robert K. Franklin of Houston (left), chairman of the National Board of Regents of the National Oil Equipment Manufacturers and Delegates Society and president of Rolo

Manufacuring Co., will combine business and society duties in a trip to Venezuela. Here he is briefed by Rafael Davila, Venezuelan consul general. Franklin will discuss with Venezuelan oil men various items concerning the Nomads and, in particular, the annual luncheon meeting which will be held in November at Chicago.

Both store and depot are complete new installations. The spare-parts depot is the first such brought to the drilling industry. It will offer drillers throughout the Louisiana Gulf Coast area and all offshore operators expedient service for needed parts for Emsco drilling equipment and Gardner-Denver mud pumps.

Interesting to visitors was the new Gardner-Denver mud pump, Model GH-GXH, rated at 1,250 hp. at 65 r.p.m. This is the largest mud pump ever built.

Continental Supply Opens New Store At Morgan City

Over 600 guests attend gala event; Broussard to head store as manager

Continental Supply Co. formally opened its new store and spare-parts depot at Morgan City, La., on October 27. Over 600 guests connected with the industry attended the opening.

Billy Mills, as district service manager will head the spare-parts depot and have supervision over all Emsco and Continental machinery service engineers in the Louisiana Gulf Coast area. R. A. Broussard is manager of the store. The entire operation is under the supervision of E. A. Dunn, district manager located in Continental's New Orleans office.

Russell Berkeley, of Workover, Inc., here chats with Frederick Mayer, president of Continental Supply.

Joe Conlon, vice president, New York Belting & Packing Co., shows Frank I. Brinegar, executive vice president of Continental Supply, packaging of V-belts for easy stocking and identification.

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FOR SALE OR TRADE: 131 ft. Heavy-Duty Lee C. Moore Derrick with 18 ft. leg span, 9 ft. boxed substructure, 3 ft. wing extension, front ramp walks, pipe racks, slide rails for derrick, two catline sheave, 5 sheave crown block, serial T 2285, would trade for smaller derrick. Contact FOrest 3-4211, Wichita, Kansas.

R-6 WICHTEX drilling rig with R-6 Wichtex drawworks; 93' poles 10" and 8" with doubleboard; 145 GKBU motor; 14½" Ideco table; Oil Well 7¼" x 12" 212 pump with Waukesha 6-NKRU motor, unitized; 3,680' 4½" drill pipe; all other necessary components and parts making up complete rig ready to drill, located Bristow, Oklahoma. Call LUther 4-0595 in Tulsa or write Cherokee Drilling Company, 1122 Gaiennie Street, New Orleans, Louisiana.

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All equipment and machinery for sale at fraction of original cost.

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U.S.A.

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Tremendous Savings
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FOR SALE EQUIPMENT

PRICED TO SELL. Hydraulic pipe pulling unit, two speed 6' jacks, spiders, slips, arch bars, sill, breakout tongs, 4 cylinder displacement pump etc. All on 47 2 Ton Dodge Truck. All in good shape and ready to work. Phone SH 6-4016. J. E. Bedingfield, Box 563, Artesia, New Mexico.

ONE R. L. CARDWELL RIG complete, now running. 5000' 3½" drill pipe & One 250 Emsco complete, just completed a well. Will sell either or both of these rigs to persons or firms with good record on monthly payments with little or no down payment. P. O. Drawer 1589, Lubbock, Texas.

FOR SALE OR TRADE

#3A-6 National Drilling Machine, Spudding Top, Steel Bull Wheels Air Cooled, Steel Band Wheel, Twin Brake OCS Sand Reel, OCS Drilling Clutch, D13000 Cat Diesel Engine. All guaranteed to be in first class condition. Have extra D13000 Cat and Clutch will sell.

Butler County Drilling Co.
Wichita, Kansas

FOR SALE EQUIPMENT

FOR SALE at Oil Hill, Kansas, 1—3½" x 7" Aldrich Vertical Triplex Pump, Serial #15579, suitable for water flood work. Price $1500.00. Cities Service Oil Company—Patridge—Bartlesville.

STRUCTURAL STEEL BUILDING—12' x 35' x 120', located near Stillwater, Okla. Boswell-Frates Company, 1003 Kennedy Building, Tulsa, Oklahoma.

BESSEMER GAS COMPRESSORS—3 type 10 twins direct connected units—Boswell-Frates Company, 1003 Kennedy Building, Tulsa, Oklahoma.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units. Westinghouse 20-25-50 KW Generating Units.

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UOP RATED 144 BBL./DAY

1—Wyatt 30" x 70' Stabilizer 160# 30 tray
6—Brown fintube exchangers, 300# 140 sq. ft. 4-6 chrome.
1—5' x 96' tower, 40 tray, 135# WP.
1—6' x 34' Vacuum tower, 150#.
1—2' x 50' tower, 24 trays.
5—Welded tanks, 10' x 40', 10' x 30', 5' x 20'.
1—Ethyl lead plant.
2—Convection furnaces, 20 MIL BTU/hr.
12—Welded storage tanks, 5,000, 2,000, 1,000 bbl.
8—Hi-vol pumps, 10 x 7 x 18 6 10 x 6 x 12, 6 x 4 x 12, 6 x 3 x 8.
4—Steel Bldgs., 20 x 20, 20 x 40.
2—8½' x 25' Tanks 50#.
1—BS&B O&G separator, 10.7 mcf/day.
Large Selection of Series 15, 30 Steel Valves, 1" to 8".
Approximately 15,000 ft. Schedule 40, 80 pipe, 2" to 8".

HOT-OIL PUMPS

3 Pacific ITB, 400 gpm—2,000' hd, 735 gpm—3,100' hd.
5 Pacific 5VTB, 612 gpm—600' hd, 324 gpm—480' hd, 308 gpm—516' hd, 193 gpm—389' hd.
1 Pacific HVTB (unused) 1270 GPM—400' HD.

IN STOCK

HEAT EXCHANGERS

10—Kellogg Adm. Fltg. Hd. 2700, 2200, 1800 Sq. Ft.
6—Kellogg Steel Fltg. Hd. 1500, 800, 500 Sq. Ft.

COMPRESSORS

1 Worth LTC-6 800 hp
2 Clark RA-5 500 hp.
1 Worth LTC-3 400 hp.
3 Penn Comps 100 CFM 500 lbs. 385 CFM 160 lbs.

MISCELLANEOUS

6—Bird Centrifugals 32 x 50, 24 x 38, 18 x 28.
5—Sweetland Filters No. 12, No. 10, No. 7, No. 5.
4—Rotary Vac. Filters, 10 x 12, 8 x 10, 5 x 8.
6—Adm. 785, 742, 425 sq. ft. ht. exch.
30—304 SS shell & tube condensers 100-1000 sq. ft.
Lab Petro-Chem furnace 50,000 BTU/hr.
9—3' x 10' 410 SS Sheets.
Tremendous selection stainless steel and steel valves ½"-6".
BJ hot oil pump 3 x 9, 13 st. 325 gpm, 4500' hd.
Goulds 16" pump, 10500 gpm, 135' hd

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5½", 7", 9⅝" OD CASING ALSO AVAILABLE.
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C-34 WALKER-NEER Spudder. A-1 condition. Complete with 5 and 7-in. tools. Priced to sell. Located at Drumright, Oklahoma. Contact Box 788, or Phone 20, Drumright.

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FOR SALE: Rotary Drilling Equipment

Recently, The Republic Supply Company of California bought the entire equipment of one of California's largest drilling contractors. This equipment is now for sale. Write for complete details and prices.

DRILLING RIGS

Emsco J-1000, 142' L. C. Moore Mast, powered by three 12 cyl. Le Roi Engines, 220P Oilwell, FXQ Gardner-Denver Pumps.

Emsco A-800, 138' Ideco Full View Mast, Powered by four PTD-6 Superior Diesels, C250 and C350 National Pumps.

Emsco J-1000, 142' L. C. Moore Mast, powered by five 12 cyl. Le Roi Engines, GXR and FXQ Gardner-Denver Pumps.

National 50A, 126' L. C. Moore Mast, Powered by three WAK Waukesha Engines, FXQ Gardner-Denver, 14P-HD Oilwell Pumps.

National 50CA, 126' L. C. Moore Mast, powered by two GM Torque Converter Twins, 18P Oilwell, FXO Gardner-Denver Pumps.

National 110, 138' L. C. Moore Mast, powered by three PTD-6 Superior Diesels, D16 Emsco, FXK Gardner-Denver Pumps.

Above are complete drilling rigs with all equipment except drill pipe and blow out preventers. Complete inventories upon request.

MISCELLANEOUS EQUIPMENT

Crown Block, 6 Sheave, Emsco M-50 6 grooved 1⅛" line.

Traveling Block, Emsco NC-35 with Web Wilson 125 Ton Connector.

Compressor, Gardner-Denver ADR.

Drawworks, G-500 Emsco Double Drum with two LP600 Cummins Engines.

Engines, Hall Scott Model 357-O

Engines, Le Roi Model L-3000, (overhauled), less radiator and clutch.

Engines, Superior PTD-6 Diesel.

Generator, 15KW, 110/220 V Electric Machinery with 6 BZU Waukesha Gas Engines.

Hook, Regan Triplex, 200 Ton.

Indicator, Martin Decker Sealtite with Mud Gauge.

Pump, Emsco D6 7¼x16, powered by 2 Le Roi 12 cyl. Gas Engines

Pump, Gardner-Denver 7¼x10 FO-FXO with Caterpillar Engine D13000.

Pump, Gardner-Denver 7¼x12 FZ-FXZ, powered by GMC 6-71 twin.

Pump, Gardner-Denver 7¾x16 FQ-FXQ with 2 357-O Hall Scott Gas Engines, Chain Drive and Skids.

Pump, Ideal 6¾x12 C-150 with skids and 45" PD 10 groove sheave.

Sand Reel, Wilson Mogul with Waukesha MZAU Gas Engine Drive and Wire Line.

Swivel, Emsco Type FT, 150 Ton

Swivel, Ideal Type D, 150 Ton

Table, Emsco 20½" Model JBS

Table, Oilwell 27½"

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- 2,500,000 bbl. Storage Tanks from 500 to 100,000 bbls.
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Murray Hill 7-5280	Phone: 569	Diamond 3-4890

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U-15 DRAWWORKS, Ser. #458, with three NKU Waukesha engines and dual 15" Hydromatic Brake. Drawworks five years old. IVERSON SUPPLY COMPANY, Kermit, Texas. Phone 3491.

IMMEDIATE DELIVERY: 5060 feet; 5½" OD grade J-55 8-RT Spang smls casing; 6500 feet; 2⅜" OD grade J-55 8-RT Spang smls EUE tubing. F.O.B. Sterling, Colo. Phone LA—2-3696, Sterling, Colo.

127' TYPE B OIL WELL Jackknife Derrick with five-sheave crown, 10' x 42' x 24' Split Type Sub-Structure, steel flooring. Price, $7,500. IVERSON SUPPLY COMPANY, Kermit, Texas. Phone 3491.

FORGED STEEL FLANGES. Reconditioned 2"-12" Series 15 and 30—Weld Neck, Slip On, Orifice, Threaded, Blind. Price List on request. Vol L. Boswell, 1003 Kennedy Building, Tulsa, Okla.

PULLING UNIT, Allis-Chalmers, single drum, on skids. Tubing and rod tools. Mounted on 1955 2-ton Chevrolet truck with tandem rear end, Baumis dual drive, 4000 miles on truck. J. F. Smith—P. O. Box 864—Shawnee, Oklahoma—Phone 3404.

FOR SALE in Seminole field: 1—5000 barrel erected bolted steel tank—Price $1500.00. Cherokee Pipe Line—Patridge—Bartlesville.

3,652' 4½" O.D. converted drill pipe with J-55 couplings, 3,000# test; 3,378' 4½" O.D. 9½# J-55 new casing. Call LUther 4-0595 or write Rio Hondo Oil and Development Corp., 1122 Gaiennie Street, New Orleans, Louisiana.

FAILING 1500 H.D. drill with 4½ x 5 pump, automatic pulldown, mounted on 1951 Ford. Also Griffin water tank, mounted on 1951 Ford. Write P. O. Box 819, Longmont, Colo., Phone 1333.

SALES AND RENTALS. Used cable drilling and fishing tools, casing, production equipment; from the Southwest's largest stock of oil field supplies. Degen Pipe and Supply Co., Tulsa.

FOR SALE: 2—127' Lee C. Moore Cantilever Masts. One (1) mast with a 41'x9' substructure and one (1) Mast with 46'x9' substructure. Box J-799, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: Cable-tool Rigs, Complete with Tools: 2—R. L. Cardwell Double Drum Rigs. 1—Walker-Neer S-33 Special. Priced to sell separately or together. Todd Aaron Drilling Corporation, 305 W. Illinois, Midland, Texas. Ph. MUtual 4-8663.

HEAVY DUTY FAILING, 42' mast, 3½" Kelly, Skid mounted pump, 1000 Sullivan, 1000 Mayhew. Fred Butler, Box 481, Pueblo, Colo.

WILSON SPUDDER complete with double pole mast, all tools, 145 GK Waukesha power, dog house, light plant. 145 GK Waukesha Engine less clutch. Four years old. Very good condition. Buda. Diesel Rig-Lighting 6KW D.C. Plant with skid pickup, completely rebuilt in our shop. Mead Engine & Welding Works, Box 395, Sterling, Kansas.

WANT EQUIPMENT: Did you find the equipment you wish to purchase in this column? If not, use an "Equipment Wanted" classified advertisement to find it. It is available somewhere and Journal classified advertisements will find it. See box heading for classified rates, or write The Oil Journal.

EQUIPMENT WANTED

WANTED: Bucyrus 36 L Spudder, complete rig in good operating condition. GI 7-5052, 1510 Hunt Bldg., Tulsa, Okla.

WILL BUY FOR CASH—One complete Slim Hole Portable Drilling Rig, Diesel Power, capable of drilling slim hole to 8,000 ft. Prefer location Northern United States with equipment winterized. Box J-746, The Oil and Gas Journal, Tulsa, Oklahoma.

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Good Used Plain End 8" OD; 10" OD; 10¾" OD; 12¾" OD; 14" OD and 16" OD Line Pipe.

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P. O. Box 1468, Phone SH 4-7404,
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OILFIELD EQUIPMENT Manufacturer requires Sales Engineers in Oklahoma, Texas and Denver Areas. Industrial Engineering Degree satisfactory, age preference 26-35. Furnish resumé education, experience, salary requirement, photograph. Our employees aware this ad. Box J-798, The Oil and Gas Journal, Tulsa, Oklahoma.

Refinery Technologist

If you are a chemical engineer with 3 to 5 years experience in refinery process engineering or operation and economic analysis and have an interest in consulting and technical service type work, you should investigate this unique opportunity to capitalize on your background and to participate in the growth of an expanding technical activity of a well known company allied to the refining industry. This position offers a wide variety of assignments, industry-wide contacts with refining and process companies, technical publicity, and unlimited potential for using initiative and originality to increase responsibility. A midwest suburban location offers ideal professional environment. Send resume of qualifications to

BOX J-805,
THE OIL AND GAS JOURNAL
TULSA, OKLAHOMA.

HELP WANTED

SALES ENGINEER

Petroleum or Chemical background for Texas-Oklahoma area. Salary and liberal incentive. Write today including complete resume. Applications will be considered promptly and confidentially. Box J-787, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEERS

(South America)

Graduate Engineers with experience in drilling, production, reservoir and equipment.

Good opportunities. Liberal employe benefit plans. Salary commensurate with experience and qualifications. Knowledge of Spanish desirable but not essential.

Forward complete resumé of education and experience to

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SALES REPRESENTATIVES WANTED:

Manufacturer of Oil-Gas Separating, Treating, Metering, and Automatic Lease Equipment wants commission Sales Representatives for (1) East Texas, Southern Arkansas, Northern Louisiana, (2) Southern Louisiana, (3) Williston Basin, (4) Illinois, Indiana, Kentucky, (5) Canada, (6) Mexico, (7) Montana, Wyoming, Idaho. Protected Territories available on exclusive Contract Commission Basis to qualified and experienced men. Please give details concerning Sales Coverage, lines handled, and sales experience in first reply.

BOX J-785,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

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SENIOR MECHANICAL

San Francisco opportunity for senior electrical or mechanical engineers with experience on oil pipeline and pumping stations or gas pipeline and compressor stations.

Send resume to Manager of Employment & Placement
Industrial Relations Division

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For an immediate personal interview you may phone:

Paul Keating, PLaza 7-4400, New York City
Joe Braddick, FAirfax 3-2401, Houston, Texas
Bill Milligan, TUcker 1549, Los Angeles, Calif.
Don Palmer, DOuglas 2-4032, San Francisco, Calif.

HELP WANTED

FOREIGN EMPLOYMENT. List oil companies, drilling contractors, seismograph contractors, showing where apply foreign jobs. $5.00 cash. OIML Co., Box 2603, Tulsa, Okla.

WANTED—Graduate Petroleum or Mechanical Engineers with 3 to 6 years Drilling Experience for Drilling Engineer Employment in South Louisiana with Major Oil Company. Personnel Manager, 800 Prudential Bldg., Houston 25, Texas.

NATURAL GAS ENGINEER with engineering degree plus experience in plant design or operation. Location Tulsa. Amerada Petroleum Corporation, Gas Department. P. O. Box 2040, Tulsa, Oklahoma.

ENGINEERS: Important permanent positions available for MECHANICAL and ELECTRICAL ENGINEERS with manufacturer of equipment for the petroleum industry located in the southwestern United States. Required experience in the design and development of automatic control equipment. Positions available in Sales and Engineering departments. Salary open. Send resume to Box J-797, The Oil and Gas Journal, Tulsa, Oklahoma.

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Active Independent Oil Company has opening for graduate geologist to handle exploration work, assemble drilling deals, land trading, etc. in Mid-Continent area. Must be capable and well experienced in all phases of land work. Age limit 40. Successful experience with independent company, or as broker, preferred. This is salaried position with excellent pay. Give detailed summary of education, background, and experience in reply. Reply

BOX J-802,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

Pontiac Eastern Corp.

A new, complete refinery, currently under construction near Hattiesburg, Mississippi includes Thermafor Catalytic Cracking, Fluid Coking, Sulfuric Alkylation, Platforming, Unifining and Sulfur Recovery.

Applications are now being taken for the following positions:

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A mature and responsible person with thorough training and broad experience in both operation and maintenance of petroleum refinery equipment to have charge of both of these functions in the refinery, the pipe line and the terminal.

Chief Engineer

An engineer with general technological experience to have charge of both process design and mechanical design work. Scope of position is open and dependent on available person.

Chief Chemist

Responsible person with experience in petroleum product blending and familiarity with latest refinery laboratory methods.

Process Foreman

An operations supervisor of broad experience to work under the Plant Superintendent and to be in charge of all operating units.

Maintenance Foreman

An experienced supervisor familiar with all types of refinery equipment to work under the Plant Superintendent and to be in charge of maintenance and small construction in the refinery, pipe line and terminal.

Write, giving resumé including experience with processes listed, to

PONTIAC EASTERN CORP.
P. O. Box 1581, Corpus Christi, Texas
Applications for other positions will be taken at a later date.

HELP WANTED

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United Geophysical Corporation
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UNIVERSAL OIL PRODUCTS COMPANY
30 Algonquin Road,
DES PLAINES, ILL.

HELP WANTED

CHIEF CHEMIST with at least six years refinery experience. Must be aggressive and have some asphalt experience, for an 18,000 BPD Independent Texas Refinery. Also Chemist with at least three years experience to handle gasoline research as well as other light oil products. Apply Box J-776, The Oil and Gas Journal, Tulsa, Oklahoma.

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1—Drilling Engineer

With minimum of 7 to 8 years experience with major portion of experience in drilling operations.

2—Production and Reservoir Engineers

With minimum of 7 to 8 years experience in general production engineering, secondary recovery, cost engineering or reservoir studies.

For personal interview—CONTACT—Taylor Little, November 11, 12 & 13, Skirvin Hotel, Oklahoma City, Okla. and John T. Wilson, November 16, 17 & 18, Lamar Hotel, Houston, Texas. For other information write Employment Supervisor,

INTERNATIONAL PETROLEUM COMPANY, LIMITED
396 ALHAMBRA CIRCLE
CORAL GABLES, FLORIDA

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  (Mechanical) in process equipment construction, design, inspection, or maintenance, petroleum product testing and field evaluation or related work.
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Choice positions open in Cleveland, Toledo and Lima, Ohio.

Write, giving a complete resume of your education, experience and personal data to:

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1737-E Midland Building, Cleveland 15, Ohio

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THE STANDARD OIL COMPANY (OHIO)

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JOB OPPORTUNITY—Engineer with 5 or more years experience in Refinery Operation. Position in Development Department making economic studies of existing and proposed Refinery and Petro-Chemical Operations. Southern location—Salary Open. Write Box J-800, The Oil and Gas Journal, Tulsa, Oklahoma.

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CORPUS CHRISTI, TEXAS

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SAFETY AND FIRE SUPERVISOR
This position requires a person familiar with refinery operations and the safety and fire hazards of refineries, as well as the ability to organize and carry on a complete safety and firefighting program in a small organization.

Write, giving resumé, to
PONTIAC REFINING CORP.
P. O. Box 1581, Corpus Christi, Texas

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COME SOUTH

Major Oil Company has openings for Chemical Engineers in several phases of process engineering. Locations near New Orleans and south Arkansas, in booming industrial areas where climate and natural advantages make living more enjoyable for all the family. Attractive salary and benefits program. In reply give age, education, experience and salary expected.

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P. O. BOX 2,
NEW ORLEANS 6, LOUISIANA

PETROLEUM ENGINEER
(Reservoir)

- International Oil Company has vacancy in New York City for graduate engineer with at least 5 years experience in Reservoir Engineering. Position will require occasional trips to overseas offices to coordinate overall engineering objectives and offers good possibilities for advancement. Salary commensurate with qualifications.
- Send detailed resume covering personal data, academic achievements, experience summary and salary requirements to:

CALIFORNIA-TEXAS OIL CO., LTD.
380 MADISON AVENUE
NEW YORK 17, NEW YORK
Attn.: Personnel Dept.

SITUATIONS WANTED

ADMINISTRATIVE GEOLOGIST: 37, 15 yrs. exp. 10 years Adm., Exec., Personnel Mgr. Thoroughly acquainted all phases. Geol. degree, grad. studies, legal training. Wide exp. Rocky Mts., Texas, Canada, Mid-Continent, Ill.-Ind., N. Mex.; presently attending law school. Available 90 days. Seeks permanent position. Box 328, Valparaiso, Indiana.

DESIRE OPPORTUNITY with independent oil or gas producing company in gulf coast. Experience drilling and production. Also supervisor south La. district office. Have general land and geological experience for overall background suitable to independent. Graduate engineer, age 28. Box J-790, The Oil and Gas Journal, Tulsa, Oklahoma.

EXECUTIVE ENGINEER, mature, heavy experience project management, plant design, process development, sales. Fluent German, French, some Spanish. Desires position on management level, project engineering, department coordination, sales representation, U. S. or abroad. Box J-792, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST-GEOPHYSICIST with more than 20 years varied major company experience in all phases of exploration work in U. S. and Canada, including 5 years in Rocky Mountain area. Desires key position with aggressive independent company or operator in Rocky Mountain area. Box J-793, The Oil and Gas Journal, Tulsa, Oklahoma.

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DESIRING EMPLOYMENT with substantial independent oil Co. Have 12 years experience in the latest methods of drilling and completion and production. Can furnish necessary references. Box J-803, The Oil and Gas Journal, Tulsa, Oklahoma.

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TWENTY-FIVE YEARS Sales Engineering and Management of oil field equipment and services. Extensive contacts field and top executives. Ability, experience, flexible, fit any organization. Tulsa resident, will relocate, Houston preferred, Ft. Worth, Dallas. Box J-796, The Oil and Gas Journal, Tulsa, Oklahoma.

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Mail: Apartado 3963
N. VanMiddlesworth
Phone: 54 48 02

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CONTACT A. L. BOWLES, Box 947, Ada, Okla., for attractive drilling deal in Seminole Co., Okla., or will drill well selling ¼ to ½ interest.

640 ACRE FARMOUT Nemaha County, Kansas, directly off-setting two Viola wells that have produced 150,000 bbls. One well, complete pumping equipment on lease. R. D. Swan, 818 Kennedy Bldg., Tulsa, Oklahoma.

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Exploration 1918-1956 Engineering
Portales New Mexico

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THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

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WILL BUY OIL PRODUCING PROPERTIES

Box J-726,
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BUSINESS OPPORTUNITIES

FINANCIAL CONTACTS, Underwriters, Brokers, Private Finders of Capital reached. No shopping. Confidential. FREE ENTERPRISE ASSOCIATES 817—51st St., Brooklyn, N. Y.

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A reputable New York firm, presently engaged in oil transportation, is interested in purchasing a firm which is engaged in another phase of the petroleum industry, in the Metropolitan New York area. Price range $200,000/$400,000. Might consider higher price range depending on circumstances. Prefer wholesale end of business or bulk storage. Must stand rigid investigation and have considerable possibilities of expansion. Please elaborate fully in first letter. Replies held confidential.

BOX J-789,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

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Mailing Lists of Oil Industry. Free descriptive catalogue. Write: Oil Industry Mailing List Co., 405 Tuloma Bldg., Tulsa, Okla.

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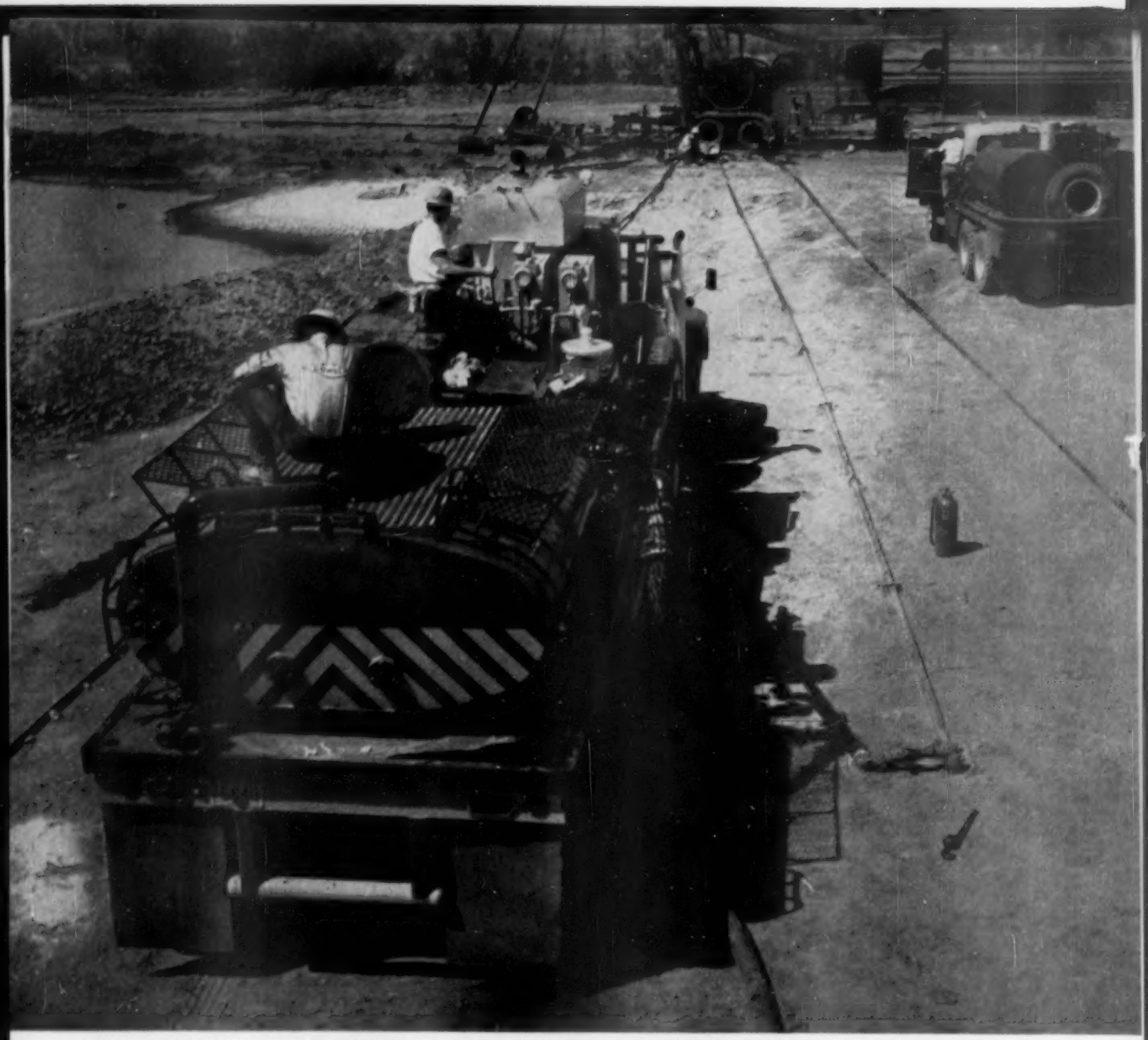

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services for the oil industry

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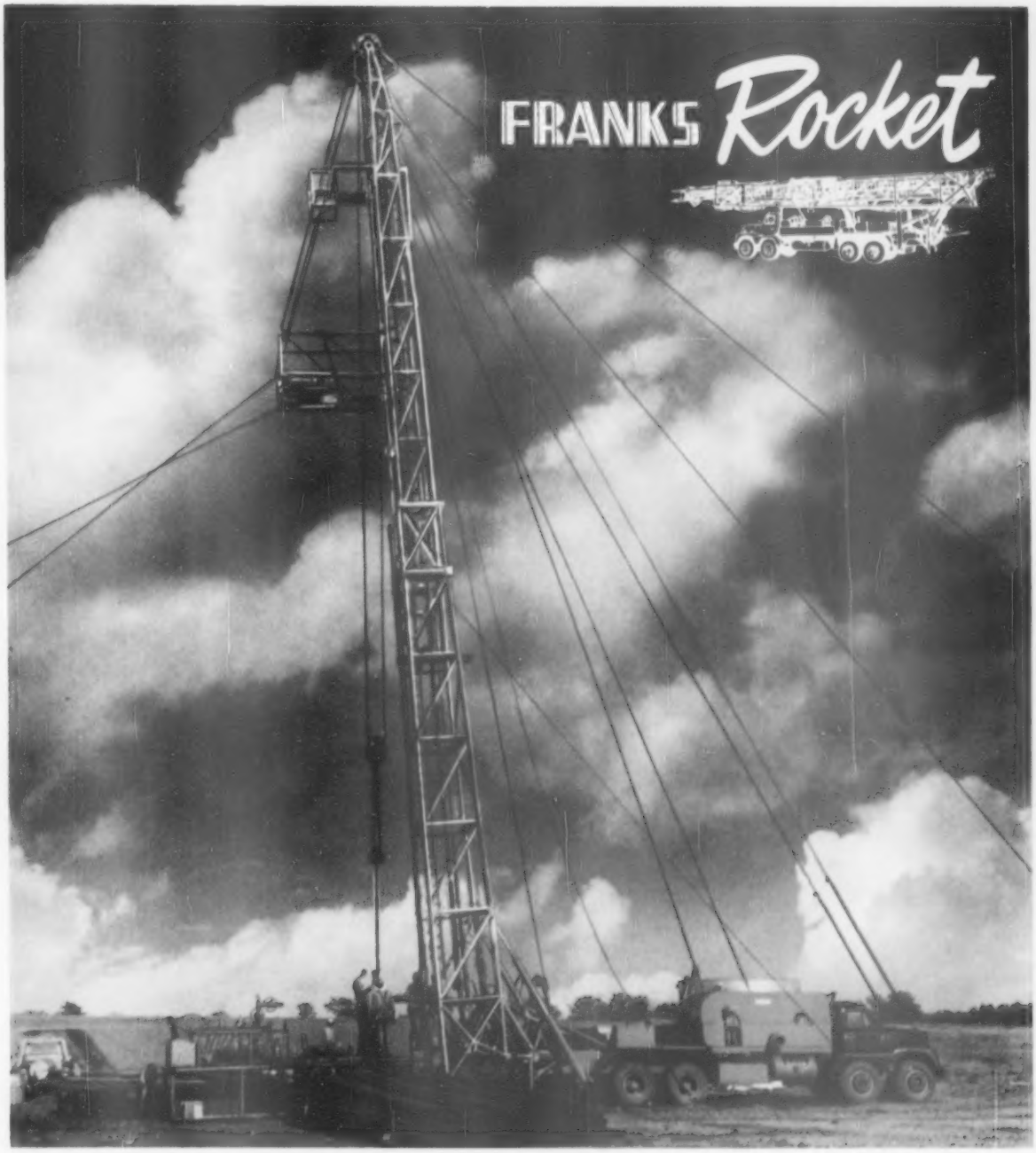
A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY



Economical Well Pulling Power

The weight distribution on a FRANKS ROCKET, with tandem front end, *can save you money.* More mileage per dollar of fuel and maintenance!

The ROCKET gets you to the job economically . . . then, on the job, the ROCKET is designed and equipped to handle any well servicing operation quickly and easily. The telescoping derrick accommodations protects rods and tubing and saves time coming out and going in. There's three ROCKET models . . . one with the most economical capacity to handle work in your area. Want proof? Ask the contractor who operates one.

For specifications, performance data or prices . . . write:

FRANKS Division of Cabot Shops, Inc. P. O. Box 3218, Tulsa, Okla.

WELL SERVICING AND DRILLING UNITS

FRANKS

DIVISION OF CABOT

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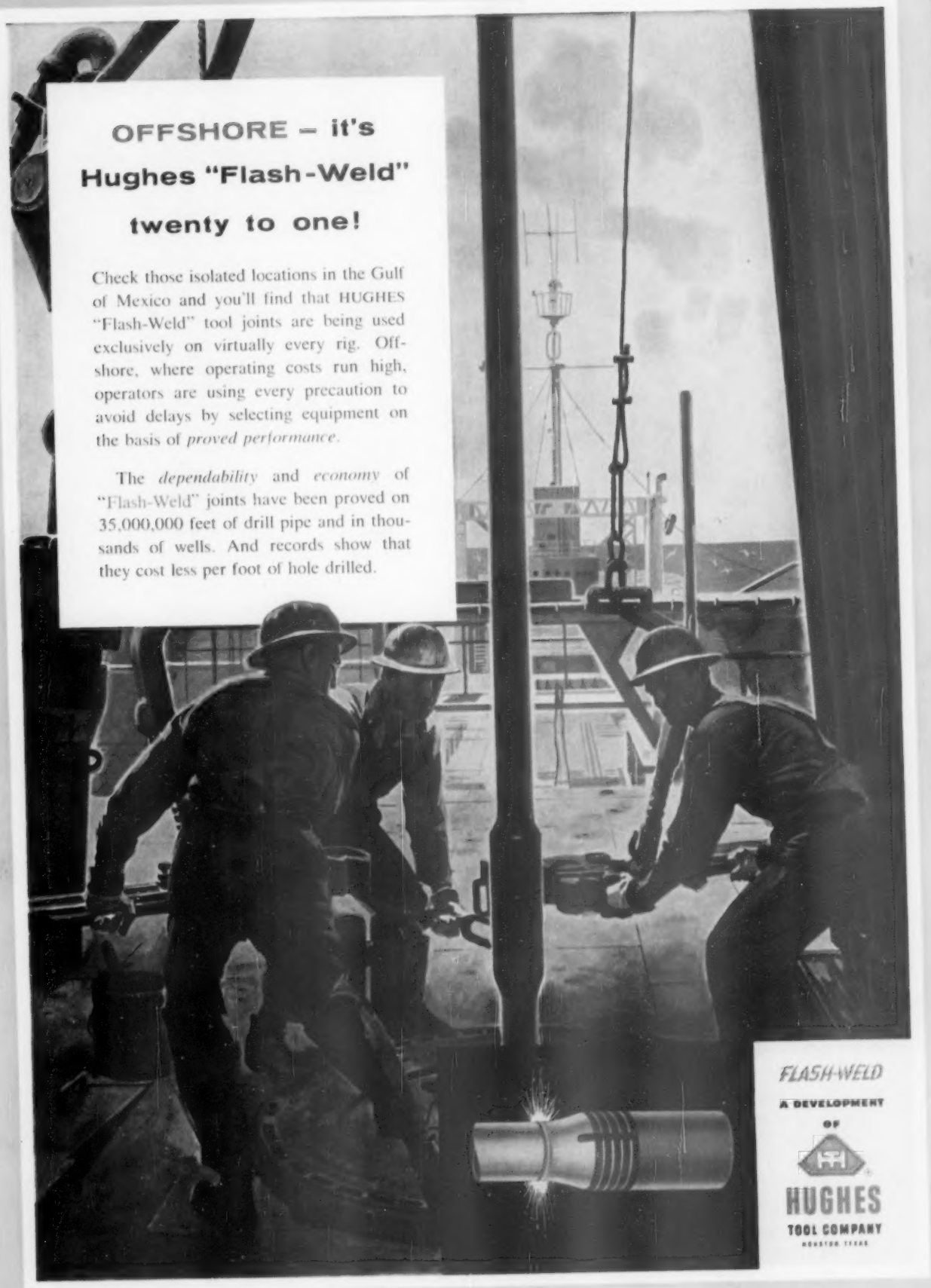

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Check those isolated locations in the Gulf of Mexico and you'll find that HUGHES "Flash-Weld" tool joints are being used exclusively on virtually every rig. Offshore, where operating costs run high, operators are using every precaution to avoid delays by selecting equipment on the basis of *proved performance*.

The *dependability* and *economy* of "Flash-Weld" joints have been proved on 35,000,000 feet of drill pipe and in thousands of wells. And records show that they cost less per foot of hole drilled.

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